

ORDNANCE MAPS.

CORRESPONDENCE

RESPECTING

THE SCALE FOR THE ORDNANCE SURVEY;

AND UPON

CONTOURING AND HILL
DELINEATION.

Presented to both Houses of Parliament by Command of Her Majesty.



LONDON:

PRINTED BY GEORGE EDWARD EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

1854.



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CORRESPONDENCE, &c.

Correspondence between the Treasury and Ordnance, and
Letter from the Duke of Wellington, preliminary
to the establishment of the Six-inch Scale for the
Ordnance Maps in 1840.

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between the Treas-
ury and Ordnance
in 1840.

No. 1.

The SECRETARY to the BOARD of ORDNANCE to Sir C. TREVELYAN.

Office of Ordnance, May 15, 1840.

I have the honour, by command of the Master-General and Board of Ordnance, to request you will lay before the Lords Commissioners of Her Majesty's Treasury the inclosed copy of a report from Colonel Colby of the Royal Engineers, dated the 6th instant, with a minute annexed by the Inspector-General of Fortifications, dated the 11th instant, pointing out the necessity for a decision as to the scale on which the result of the Ordnance Survey of Scotland shall be published, and proposing that two maps be engraved, one on a scale of six inches to a mile, and another on a scale of three miles to an inch; and I am to request you will move their Lordships to bring the same under the consideration of the Government, and favour the Master-General and Board with a decision on the questions proposed.

Inclosure 1 in No. 1.

Colonel Colby, Royal Engineers, to the Inspector-General of Fortifications, reporting, in obedience to the Master-General's Order of the 9th instant, on the state of the triangulation in the county of Ross, and that the survey of that county will be expedited by allowing the principal triangulation of Scotland to proceed regularly.

COLONEL COLBY to the INSPECTOR-GENERAL OF FORTIFICATIONS.

Ordnance Map Office, April 15, 1840.

In obedience to the Master-General's Order of the 9th instant, I have the honour to report that the principal triangulation which is to serve as the basis of the survey of Scotland, has not yet been completed over the whole county of Ross. That triangulation has been extended over the Zetland and Orkney Islands, connecting them with the north of Scotland, and of the Western Islands. The work of the present season will be partly in Ross-shire. And I am not aware of any step which could this year be taken to expedite the survey of that county more than the preparation for it; as it will be expedited in the regular course of the principal triangulation of Scotland.

Some of the surveying parties will be ready to leave Ireland about the beginning of the next year; and it is therefore highly desirable that the nature of the survey, which is to be carried over Scotland, should be thoroughly considered and determined during the present year, to prevent the recurrence of such delays and expenses as have operated against both the English and Irish surveys, from the progressive improvements demanded since their commencement.

An early decision on this subject will enable me to frame arrangements to meet the wishes of the country, and to make a survey suitable to its proposed objects, with the least cost of time and money.

Coul, Dingwall, N.B., April 6, 1840.

Sir George Mackenzie presents his compliments to the Master-General of the Ordnance, and requests to know, whether in the event of a subscription for the Ordnance Map of the county of Ross being made by the gentlemen of the county, or by their contributing in any other manner towards the work, the triangulations will be forthwith filled up and the survey completed?

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between the Treas-
ury and Ordnance
in 1840.

Sir G. regrets that he was lately obliged to leave London before he could personally have had the honour to make this inquiry; and he now respectfully requests an answer, in order, if it be favourable, to enable him to communicate with the county gentlemen and others interested, without delay.

The nature of the county, nine-tenths of it being open, will not cause so much labour as counties more extensively cultivated, but with the view to improvements of various kinds, the map will be of the utmost service.

Forwarded to the Master-General, in compliance with the minute from his office, dated the 9th instant, on the inclosed note of the 6th, from Sir George Mackenzie.

FK. WM. MR.

April 18, 1840.

Ansd. Sir G. Mackenzie 23, inclosing extract of report from * to *.

Inclosure 2 in No. 1.

COLONEL COLBY, Royal Engineers, to the INSPECTOR-GENERAL OF FORTIFICATIONS, reporting, in obedience to the Master-General's orders, on the nature and scale of the survey shortly to be commenced in Scotland.

COLONEL COLBY to the INSPECTOR-GENERAL OF FORTIFICATIONS.

Ordnance Map Office, Tower, May 6, 1840.

In obedience to the Master-General's order, that I should report specifically with reference to the recommendation in my letter of the 15th ultimo, "that the nature of the survey which is to be carried over Scotland should be thoroughly considered and determined at an early period:"

It is expedient that I should commence by a brief retrospect of some of the causes of delay, expense, and insufficiency, which have operated against the English and Irish surveys. The progress of knowledge of almost every kind has shown the imperfection of early efforts, and in pointing out instances of want of foresight in the early stages of the English and Irish surveys, I wish to avoid any censure being inferred from my statements, as I merely bring them into notice as a caution for future cases. The purposes for which those surveys have been designed have been gradually developed, and the cause for regret is, that those purposes had not been all originally known.

1st. The principal triangulation on which the survey of South Britain has been based, was partly designed for astronomical purposes, and partly for a map on a small scale.*

2d. The detail plans were commenced by officers of the Royal Engineers, partly for the purpose of practising them in military drawing, and partly for the purpose of forming military plans of some portions of Kent for the use of the Ordnance.

3d. When the officers of Royal Engineers were too much engaged in military works to admit of their being extensively employed in military drawing, a corps of Royal Military Surveyors and Draftsmen was formed for home and foreign service. The gentlemen of this corps were employed and practised in making detailed military plans in South Britain, their instruction being the principal object, and the plans which were used in forming a military map being of secondary importance.

4th. The publication of some parts of this military map, on a scale of one inch to a mile; created a desire among the public to possess better maps than had formerly existed. Additional surveyors were then hired to advance the progress of the military map.

5th. The map was considered solely as a military map; its publication was at one time during the war suspended, and after the general peace its continuance became a question of doubt, until it met with support in the House of Commons.

* It was commenced by Major-General William Roy in 1784, and after about four years of suspension, was recommenced by Lieutenant-Colonel Edward Williams and Captain Mudge, of the Royal Artillery.

6th. The desire for the map, as a military map, having ceased with the war, and its progress being rendered exceedingly slow from motives of public economy, the gentlemen of Lincolnshire and Rutlandshire proposed to the Government to proceed with the map of their district out of its regular turn, upon condition of their becoming subscribers for a certain number of copies of the map. These gentlemen partly wished for the map for their use in hunting, and partly for the improvement of the country, in marking out the drainage of the fens, &c. This proposition had been acceded to, and some progress had been made in it before the charge of the survey devolved upon me in 1820.

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ury and Ordnance
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I applied for the aid of more officers of Royal Engineers, and employed them in examining the old plans which had been made by contract, with a view to their inserting upon those plans the alterations which had subsequently taken place in the country. To my great regret I found that the contract plans had, in very few instances, possessed the original accuracy which would have fitted them to form the kind of map which was required by the country.

The officers had not only to insert additions, but to revise and correct the plans themselves; and, after intense labour on their part, a map was produced better than any preceding map, but not satisfactory as a national work.

7th. The insufficiency of this system of contract-plans having been fully demonstrated by local examinations, it became necessary to take steps for revising and correcting the contract-plans which were still not engraved. This part of the work is now nearly completed, but its progress has been laborious, slow, costly, and unsatisfactory in the result. In addition to the revision of these plans, it has also been necessary to revise and re-engrave much of the work which had been formerly engraved for a military map, because it did not possess the accuracy required by the Admiralty in forming the basis of their coast-surveys, for the geological survey of M. de la Beche, or for the Civil Engineers. Thus, a cost of time and money has been bestowed upon the English map which, had the original design been founded on a thorough knowledge of its future uses, would have gone far towards the progress of a national map on a larger scale, and fitted to receive additions, marking the progress of society from time to time, at a trifling expense.

8th. The survey of Ireland commenced in 1825, under far more favourable circumstances than the Ordnance Map of England and Wales. The impediments to the success of the English survey, and their causes, were at that time known to me. The House of Commons had passed an Act defining the principal object for the survey of Ireland, prescribing a legal mode for ascertaining the boundaries which were to be surveyed, granting the surveyors power to enter lands for the purposes of the survey, and preventing the removal of the objects used, and other obstructions to the survey by penalties; and the Duke of Wellington, as Master-General of the Ordnance, was anxious to render the survey fully effective.

9th. A general survey of a country so large as Ireland, over every part of which the accuracy of detail which should be attained in a survey of a small estate was to be extended, was an entirely new work, for which the ordinary processes of surveying were wholly inadequate. The first labour was, therefore, to devise instruments and a system for its execution, and to solicit the requisite general authorities to carry the work into effect.

10th. The Duke of Wellington, and those around him in the Ordnance, perceived the excessive difficulties to be encountered, and they smoothed them as far as they could be smoothed by official aid. Feeling myself thus fully responsible for the success or failure of the work, I commenced the task by drawing up a code of instructions, and devising a new apparatus for the measurement of base lines, which possessed a higher degree of accuracy than any apparatus which had been previously used for a similar purpose.

11th. The principal triangulation for the survey of Ireland commenced from a more accurate base line than any preceding triangulation; the triangles are also generally better shaped; and several of their sides are the longest hitherto used. The points have been preserved by the provisions of the Act of Parliament, and the good feeling of the inhabitants toward the survey. And this triangulation would serve as the basis of any future survey on any scale, however large. Only some observations remain to be taken (which the hazy state of weather prevented), to get distances across the Channel to Great Britain.

between the Treasury and Ordnance in 1840.

12th. The number of plans of estates annually made in Great Britain and Ireland being extremely small, in comparison with the entire country, it was manifest that any attempt to obtain ready-trained surveyors in large numbers, by means of high prices, would be costly, and ineffectual in the result. I therefore turned my attention to the corps of Royal Engineers, and to military organization, for the execution of the detail survey, as well as for the triangulation of Ireland.

13th. The military officers were acquainted with the general principles and practice of surveying; but being unaccustomed to the valuation of land, they could not comprehend the importance of the fastidious proofs of accuracy which my instructions enjoined. They had been taught military surveying; they knew that such accuracy could not be required for any military purpose; they had the severe personal labour of training all their assistants; and, besides the valuable assistance obtained from the corps of Royal Sappers and Miners, they had many civilians who had been surveyors, and who universally objected to the severe tests their work had to undergo. The work proceeded with appalling slowness, while the country was demanding the most unattainable celerity. The detail survey had commenced before the points could be sufficiently advanced to enable the officers to lay their work down and draw it. Everything seemed to them to be wrong; and they importuned me to relax the severity of my instructions to enable them to proceed with the work to satisfy the country. There was difficulty in maintaining the discipline of the soldiers; assistants left them half-trained; and their labour of teaching seemed to them to be endless and unprofitable. They feared for the compromise of their characters; and when they found me immoveably determined to risk my reputation on my instructions, they were astonished at my obstinate adherence to opinions which I had formed and penned without experience, and in which I stood alone and unsupported. An appeal was made to the Master-General; an investigation was ordered; my instructions were partly rescinded; and the plans advanced with more rapidity. I continued to object to the introduction of less accurate methods than I had hitherto enjoined; and the land-valuers under the Irish Government commenced their valuation, using the Ordnance plans. They soon began to complain of their errors, and to ask for the additional detail of the boundaries of the cultivated land.

A costly revision of the plans which had been done was now unavoidable to fit the plans for the valuers, and as none but well-trained surveyors can be employed in revising imperfect plans, and such surveyors receive the highest rates of pay, it would not have added much to the cost to have commenced the detail survey a second time. My original instructions were again considered, and restored into complete operation.

Some time necessarily elapsed before the surveyors could be induced to forego their erroneous mode of working, and be trained to habits of rigid accuracy. But here the advantages of military organization were most eminently manifested, for the officers of Royal Engineers, and the non-commissioned officers and soldiers of Royal Sappers and Miners, laboured to carry the instructions into effect with the most unflinching determination. The civil assistants increased in number and intelligence, and it is long since any error in the survey of Ireland has been discovered or complained of, while the rapidity of its progress is enormous compared with the quantity of detail information it contains.

14th. The secondary triangulation for the survey of Ireland was commenced in conjunction with the detail survey by the officers commanding districts, because no officers could then be spared for the separate duty. But two inconveniences clung to this arrangement: the one, the abstraction of the personal attention of the district officer from the charge of his district; the other, the want of a general disposition of the secondary triangles with reference to the principal triangles on which they were based, and occasional small anomalies in the determinations of the altitudes of points in adjoining districts. As soon, therefore, as the principal triangulation was sufficiently advanced to enable me to attach a separate officer to the duty, I did so. With the secondary triangulation, lines of altitude are carried across the country in various directions; they commence and terminate at tide-gauges on the coasts, and from them the altitudes of all the secondary points are determined. The secondary triangulation of Ireland, as far as it has proceeded, would serve as the basis of any future survey of the country on any scale, however large.

15th. The detail survey of Ireland having been directed by the original recommendation of the Committee of the House of Commons to be laid down on the scale of six inches to a mile; the legal boundaries of the townlands, baronies, counties, and parishes having to be laid down in conformity with the provisions of the Act Geo. IV. c. 99; the valuers requiring the boundaries of cultivated land and the areas of the legal divisions with more accuracy than can be obtained by admeasurements from plans on a scale of six inches to a mile, as well as a minute survey of all the principal towns on a scale of five feet to a mile for their valuation of buildings; the Admiralty requiring the coasts of the sea and the shores of the navigable rivers and lakes with great accuracy, to enable them to lay down their currents, soundings, and low-water lines; the Ordnance requiring surveys of their land; the Railway Commissioners, Shannon Commissioners, Board of Public Works, and County Surveyors requiring many details and altitudes throughout the country to enable them to judge and carry forward local improvements; altogether define pretty well the nature of the survey required for Ireland. Such a survey must necessarily be very elaborate and costly, and any material imperfections in it would defeat the object of the legislature.

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ury and Ordnance
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Having provided for principal and secondary triangulations of an unexceptionable quality, the next care was to receive the legal boundaries in the manner pointed out by the Act of Parliament, and to provide proofs that the boundaries surveyed and laid down on the Ordnance plans were those legally received; these proofs are preserved to attest the boundaries.

Having surveyed the townlands and other divisions directed by the Act, these surveys are laid down on content plots, and their areas are numerically computed from registers taken from the field-books, and are sufficient to compete with surveys laid down on any scale however large. These content plots and registers are preserved to attest the areas.

The surveying chains are examined every morning, and their length recorded in the field-books before they are used; the dates, the state of the weather, the names of the surveyors and their labourers, are also recorded daily in the field-books. All the field-books are preserved, and there is a regular reference to them by which any book may be immediately found, and there are similar facilities for referring to plots, name-books and other authorities for the detail survey, so that any part which is questioned may be immediately referred to, and it can be shown on what day, by what persons, and every circumstance that attended the survey of that part; yet the whole details of 14 counties are arranged in a part of a fire-proof room only 19 feet square.

16th. Two circumstances induced me to recommend an engraving on copper of the detail survey of Ireland on its original scale of six inches to one mile: one, the difficulty and cost of making the number of fac-simile manuscript copies of the plans required for legal uses, which could not have been less than the cost of engraving; the other, the certainty of uniformity, the increased perfection of the plans on copper, the facility for future corrections and additions, and the general public utility arising from the easy distribution of copies.

In engraving the detail survey of Ireland on its original scale, the sheets of copper are first prepared by having margin lines drawn on them, so as to form parallelograms, 32,000 feet by 21,000 feet, in the proportion of the scale; all the trigonometrical points are then laid down on the copper with reference to these lines, and tracings on transparent paper from the field plans are fitted to these points on the copper.

The process of engraving, therefore, confines the distortion which may have taken place in the original plans from heat or damp to almost inappreciable limits, from the closeness of the trigonometrical points to one another.

As the margin lines of the plates have all been calculated with reference to the triangulation, there is no difficulty in putting together any number of the sheets, or in obtaining from them distances in any direction. The effect of expansion or contraction of the paper after printing may be estimated from the known lengths of the margin lines, and a proper correction may be applied to any distance measured on them.

The trigonometrical points are many of them objects which are of a permanent nature and likely to remain in the country; the boundaries of townlands, baronies, counties, and parishes having a reference to property, are also likely to remain known and unchanged in the country. Having these and other

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permanent objects, which are now correctly marked on the engravings unchanged, it will be easy at a small expense to add on these sheets of copper the additional buildings, roads, &c., which will be made from time to time in the progress of society. These sheets, therefore, form the basis of a permanent map of Ireland.

17th. In addition to the cadastral map of Ireland on the scale of six inches to one mile, a general map similar to the map of England and Wales on a scale of one inch to a mile, with the hills shaded on it, has been directed, but two reasons have induced me to defer the commencement of the engraving of this map: the one, the advantage of throwing the whole force of the engraving department upon the progress of the cadastral map until it is completed; the other, the advantage of having the whole country ready surveyed, and the engraving department free to commence and complete the whole map in a short period and in a uniform style. The sketching of the hills has made considerable progress, and it has been done on the scale of one inch to a mile, to save the expense of further reduction. It is, however, still very costly, and I have not yet seen any mode of drawing hills on maps which is perfectly satisfactory. A great many methods have been tried upon the continent, and I have caused many experiments to be made upon the survey in England. Some of them certainly very beautiful and exhibiting great skill on the part of the artists, but none that had the power of giving definite information. In fact, hill sketching had not been attempted, and the sketcher could not give to the map more definite expression than his knowledge enabled him to convey.

In the cadastral map of Ireland the altitudes marked are extremely numerous, and afford great assistance to the sketchers; still this information alone does not enable them to perfect sketches for definite use. Captain Larcom suggested running contour lines instrumentally at certain distances, as affording accurate data to regulate the delineation of hills. The use of contour lines had often been proposed by the continental writers on military plans for fortifications, &c., but the extensive use of contours, obtained by the aid of levelling instruments, had never been tried, from an apprehension of the difficulty and expense of the operation. Lieutenant Bennett has tried them over a small part of the north of Ireland with great apparent success, and the time and cost has been small compared with the result.

18th. The cost of a national survey carried over an extensive country is unavoidably large, and in commencing such a work two views present themselves for consideration; the one, a partial diminution of present cost by aiming only at an ephemeral work to answer a temporary purpose; the other, an increase of present cost to execute a work fitted for more numerous purposes, and for permanent utility. The Ordnance Survey of part of South Britain may serve as an example of the first kind; the Ordnance Survey of Ireland is an example of the second kind. A minute history of these surveys would have been tedious, but the preceding paragraphs show the prominent results. If every object which is entered in the course of a survey has its position determined and laid down with perfect correctness, any additional objects may at a future time be determined with reference to the objects already marked, and added to the work without the cost or labour of repeating former work. But if original work has been inaccurate, the cost and labour of repetition is inevitable, when additional roads, buildings, and other details are to be inserted on the map; one, therefore, of the most essential considerations at the commencement of a new national survey is the probability of additional details being required from time to time to perfect the map, and to render its utility permanent. We have, I believe, no general record of the new roads, and improvements of the lines of old roads, which have taken place in Great Britain at different periods, but the Parliamentary Returns show the progressive increase of population and of houses; and from these it may be inferred that a map, as far as it exhibits the works of man, must either receive frequent additions or become obsolete in a small number of years.

From 1801 to 1831, the increase of population in England was 57·1 per cent.; in Wales, 48·9 per cent.; in Scotland, 47·9 per cent.; and the increase of houses in England was 60·3 per cent.; in Wales, 44·8 per cent.; in Scotland, 25·7 per cent.; but this comparative small increase of houses in Scotland appears to be due to some inaccuracy in the first returns, as the increase from 1811 to 1831 is 23·3 per cent. for 20 years. In the manufacturing districts of

England, Wales, and Scotland, the increases have been much more rapid during the period from 1801 to 1831: in Lancashire, the increase of population was 98·7 per cent., and of houses 103 per cent.; in Glamorganshire, the increase of population was 77 per cent., and of houses 70 per cent.; and in Lanarkshire, the increase of population was 116 per cent., and of houses 81 per cent. In England, the increases of population and houses have advanced in an increasing ratio, and, using the ratio which the returns indicate, there can be no doubt but that the population and houses have been doubled since the commencement of the survey, and that there have been proportionate alterations of roads, &c.

19th. The principal triangulation, which is now considerably advanced in Scotland, is carrying forward on the most accurate principles, and is adequate to form the basis of a survey on any scale whatever.

20th. The secondary triangulation for Scotland has not been commenced, but it is desirable that it should be begun as early as means can be provided for its execution, because much time is lost in surveying if the points to which the surveys are to be fitted have not been previously fixed, and field-surveyors from the survey of Ireland will now become disposable for other work. The nature of the survey, and the scale on which it is to be drawn, should be decided before the secondary triangulation is commenced, because the number and disposition of the points must be suited to the survey.

21st. I am not sufficiently conversant with the nature and uses of the legal boundaries in Scotland to offer any opinion respecting those which should be laid down on the map. But whatever boundaries are required to be surveyed should be pointed out on the ground to the Ordnance Surveyors in some manner which has been directed by an Act of Parliament. The time and expense of inquiring which are the lines of boundary on the ground, the obstructions which would be offered to passing through fields to discover and survey them, and, above all, the uncertainty and want of legal evidence of the accuracy of the boundaries when laid down, would render it both useless and expensive to attempt to lay down the bounds of counties, parishes, &c., without such a preliminary authority.

The Act Geo. IV. cap. 99, by which the local boundaries are discovered and pointed out to the Ordnance Surveyors in Ireland, has answered its purpose, both as to laying down the boundaries, and preserving the objects used in the survey, which is equally important. But for Scotland, the Act would require special consideration from the gentlemen of that country.

22d. One principal source of expense in the Survey in Ireland is the calculation of the areas of townlands, to obtain the accuracy which the regulation of the county assessments requires. This source of cost might, probably, be wholly saved in the survey of Scotland; because I am not aware of any national purpose for which such accurate determinations of the relative areas of parishes or other divisions would be wanted in that country.

23d. No national survey can be expected to supersede future local surveys for the execution of canals, railroads, or other works; but a national survey should answer the preliminary purposes of aiding in the selection of the fittest general positions of such works, and also the legislative purposes of enabling the Government to examine and judge more correctly of the comparative eligibility of proposed or competing lines for canals, roads, railroads, &c. In short, it should be on a sufficiently large scale to answer all the general purposes of local improvement; and the additional first cost is by no means commensurate to the enlargement of the scale of a survey.

For reasons already stated, the English and Irish surveys do not, from their total expenses, afford any just criterion to judge of the probable comparative cost of a survey of Scotland on the smaller or the larger scale. But from the running expenses of the two surveys, it may be inferred that an accurate survey of the outline (setting aside areas) may be made and engraved on a scale of six inches to a mile, similar to the Ordnance map of Ireland, for less than double the cost of an accurate map on a scale of one inch to a mile.

24th. Besides the ordinary purposes of general improvement, for which national surveys are essential, special enactments have sometimes been made, which render national surveys of a particular nature indispensable. The Tithe commutation Act for England and Wales is the most costly instance of this kind. Being in progress simultaneously with the Ordnance Surveys of England and Ireland, it has drawn from those surveys very large numbers of draftsmen,

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and has thus increased their expense and diminished their advancement to a very great amount. It is carried on under the direction and at the expense of the parishes. This enormous competition for surveyors and draftsmen, who are under no central control, raises the price beyond that of any regular national survey, while many of the plans produced are mere compilations from old surveys, without possessing the accuracy which would render them available for any other object; and not being engraved, they afford no facility for obtaining copies for appeals against unjust apportionments. The English Ordnance Survey being only on a scale of one inch to a mile, and not exhibiting any parish boundaries, was not useful for this object; but the Irish Ordnance Survey on the larger scale, with the detail it embraces, would have left little to be surveyed for a similar object in that country. And the probable demands for general surveys in Scotland should now, therefore, be well considered, that no second general survey may be required.

25th. A survey of Scotland, laid down and engraved on squared sheets of copper, on a scale of six inches to one mile, having the trigonometrical points, boundaries, roads, rivers, canals, buildings, &c., marked on the copper in their true relative positions, together with several altitudes in feet of remarkable points above the level of the sea, and contour lines or lines of equal altitude at given elevations, also marked, would serve as a basis for a permanent map of Scotland. In order to diminish the original outlay on the survey and engraving, the quantity of detail given in the mountainous districts might be very little, provided a sufficient number of definite objects were laid down for future reference, in the event of the discovery of minerals or other improvements, rendering it desirable to add to the details already shown on the sheets. Thus a foundation map might be prepared and added to from time to time, from which maps on other scales might be reduced, and published whenever they were required. It would also be requisite to preserve the field-books and other documents from which the original survey had been laid down, that any particular district might, if required at any time, be laid down on a larger scale, without the expense of a re-survey.

As the proposed engravings on the six inches to a mile would be only outlines, impressions from the sheets might be sold at a small price, but they would not answer the ordinary purposes of a travelling map, and a map on a scale of one inch to a mile is also rather large for those common purposes. The cost of drawing and engraving a shaded map on a scale of one inch to a mile is very large, and where there is an outline-map on a fitter scale for local purposes of improvement this cost may possibly be reduced very considerably, without any corresponding inconvenience to the public, by making the general shaded map of Scotland on a scale of three miles to an inch.

In these suggestions I have endeavoured to point out the leading difficulties which our national surveys have had to encounter, and the cheapest mode of making such a survey of Scotland as may be permanently useful to that country. It is also necessary I should state, that much of the cost of the survey will depend on the rapidity with which it can be executed and the means provided for its execution, among which one of the most essential will be a good house for an office situated near the work in Scotland.

Forwarded to the Master-General for his information and orders.

Colonel Colby's letter of the 15th ultimo, to which he refers, was sent to the Master-General with my Minute of the 18th.

It appears to me essentially necessary that Her Majesty's Government should now take into consideration, and determine as early as possible, the scale of the Survey of Scotland.

I think this report, and indeed the general tenour of the applications which have been made by civil engineers and other parties for reference to the original documents, fully prove that the present scale of the Ordnance Map of England and Wales, whilst the expense of drawing and engraving is stated to be very large, is not practically useful for local improvement, and for the general purposes of civil economy; and as regards military objects, it is likewise too small for delineating works of defence or describing tactics, whilst a smaller map would be more convenient for tracing routes of columns, as well as for all travelling purposes.

Colonel Colby, therefore, sums up this Report with recommending two maps—as in Ireland—the small one, a general shaded map of Scotland, to be on a scale of three miles to an inch, and the large survey having the boundaries, roads, rivers, canals and buildings, with altitudes, &c., on a scale of six inches to a mile.

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ury and Ordnance
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This is a question which I presume should be referred to Her Majesty's Government; and if two maps be decided, the scale of the former may probably be determined by the Master-General in communication with the Quarter-Master-General; but the exact scale for the large survey will, I think, require more general information, from civil engineers, from geologists, and probably from the Board of Works in Ireland; and I shall then, if desired, be prepared to give an opinion how far what is suggested by these parties may be useful or not for Ordnance purposes.

The decision of the above question will probably also involve the consideration, whether, in the event of adopting two scales, the system should not be at once introduced for the remainder of the English survey, now extending into the manufacturing districts.

May 11, 1840.

F. W. MULCASTER.

Referred to the Board, in order that a letter may be prepared, submitting the consideration of the important questions, to which the letter of Colonel Colby and the Minute of the I. G. F. have reference, to Her Majesty's Government.

May 12, 1840.

H. VIVIAN.

Ordered that a copy of the Report, dated the 6th instant, from Colonel Colby and of that of the Inspector-General of Fortifications annexed, be prepared and transmitted to the Lords Commissioners of the Treasury, with the request of the Master-General and Board, that the questions therein referred to may be submitted for the consideration and decision of Her Majesty's Government.

May 15, 1840.

E. ANSON.

B. V. D.

D—d.

Treasury Minute on the above, dated May 28, 1840.

Write to the Secretary to the Ordnance, that previously to submitting to the decision of Her Majesty's Government the question of the mode in which the results of the Ordnance Survey of Scotland shall be recorded, my Lords would wish to be favoured with the opinion of the Master-General and Board on the subject.

State that my Lords also request to be informed whether the Master-General and Board consider it to be necessary or desirable that the subject should be laid before the scientific and other bodies adverted to by Colonel Mulcaster, for their opinion.

Also that, although my Lords are well aware that it would be very bad economy to record in an imperfect manner the results of a survey on which so much skill and labour will be bestowed, they still think it right that they should have before them an estimate of the comparative expense of the different scales on which the map might be published; and they will feel obliged if the Master-General and Board will procure the necessary information for them.

Also, that my Lords wish to be informed to what extent the charge for surveying boundaries, and the other expenses attending the construction of the Ordnance maps, have hitherto been defrayed out of local funds, and whether the Master-General and Board are of opinion that, with reference to the local objects to which these maps will be subsidiary in Scotland, it will be practicable to provide for a portion of the expense in a similar manner.

The SECRETARY TO THE BOARD OF ORDNANCE to Sir C. TREVELYAN.

Office of Ordnance, July 24, 1840.

Having submitted to the Master-General and Board of Ordnance your letter dated the 2d ultimo, requesting information on certain points to enable the Lords Commissioners of Her Majesty's Treasury to decide upon the scale on which the Ordnance Survey of Scotland shall be made;

I have the honour, by the Master-General and Board's commands, to request you will submit to their Lordships the inclosed copies of reports from Colonel Colby, of the Royal Engineers, dated 18th and 22d ultimo, and 11th instant, relative to the Surveys of Scotland, and England, and Wales respectively,

The Master-General and Board presume their Lordships will at once see the vast importance of the subject, and the necessity of the decision of Her Majesty's Government upon it being communicated to this department as early as possible.

The questions to be determined on are the following:

1st. Whether the Ordnance Survey of England shall be continued on the present scale, and the survey about to be made of Scotland be also on the same scale?

2dly. Whether England alone shall be continued on the same scale, and the survey of Scotland be laid down on a scale of six inches to a mile, similar to that of Ireland? or

3dly. Whether the English counties still to be surveyed, and the whole of Scotland, shall be on a scale similar to that of Ireland?

Colonel Colby in the inclosed reports has so fully entered into all the points bearing on these questions, and explained the advantages that would be derived from the survey (especially of the mineral and manufacturing districts of England) being on a larger scale, and the little use that it has been possible to make of the English maps for very many of the important objects for which a most accurate survey has of late been required, that the Master-General and Board will not trouble their Lordships further than to express their decided opinion, after giving the subject the fullest and best consideration, that it would be of infinite advantage to the country to carry out the views of Colonel Colby.

The Master-General and Board think it right to mention that this is a subject which has been much pressed on them, not only by several members of Parliament, but by men of science and of consideration connected with the mining and manufacturing districts; and that within the last few weeks a question has arisen in respect to some Duchy of Lancaster property in Wales which has shown how very advantageous it would have been had the Ordnance map of the district been on the same scale as the map of Ireland.

In regard also to the survey of parishes under the Tithe Act, in affording data for laying down railroads, &c., the insufficiency of the English maps has constantly been complained of; in fact, for such purposes they have been found of little or no use; whilst those of Ireland have proved fully sufficient for every object for which a survey could be required.

Annexed to Colonel Colby's reports are remarks by Lieutenant-General Sir F. Mulcaster, Inspector-General of Fortifications.

Inclosure 1 in No. 2.

COLONEL COLBY to the INSPECTOR-GENERAL OF FORTIFICATIONS.

Ordnance Map Office, Tower, June 18, 1840.

In reference to your order on the Honourable Board's letter of the 10th instant, I have the honour to state that the survey of the manufacturing and mining districts in the north of England being now in progress on a scale which does not admit of the minuteness of detail which will be hereafter required for the geological surveys of those districts, and which would now be useful to the proprietors, it is highly desirable, if any alteration of scale is contemplated, that that alteration should be immediately considered and decided on; because the cost of the present survey for the small scale in those districts might thus be wholly saved. Whereas, if the decision be postponed until the estimates for the next year are under consideration, a portion of those districts will have been surveyed and require the cost of a re-survey for the larger scale.

Inclosure 2 in No. 2.

COLONEL COLBY to the INSPECTOR-GENERAL of FORTIFICATIONS.

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ury and Ordnance
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Ordnance Map Office, Tower, June 22, 1840.

In obedience to your order of the 13th instant, on the Honourable Board's letter of the 10th instant, I have the honour to state that I am not cognizant of any scientific points connected with the proposed survey of Scotland affecting the scale for that survey, which it will be necessary now to refer to any scientific body

But it is necessary to learn from mining, manufacturing, and agricultural interests of Scotland, what kind of survey will be most conducive to the improvement of the country; because any survey which did not possess sufficient information to serve those interests, would involve a considerable expense, without an adequate national advantage. On this head the Highland Society is likely to possess more information than any other public body, as it enters into almost every question connected with the agriculture, manufacture, and commerce of Scotland.

The formation of any estimate for the probable cost of a survey of a large country is not a matter of simple calculation, like an estimate for a building, when plans and sections may be constructed showing the exact dimensions proposed, where the nature of the materials to be used is correctly specified, and where data are thus given, which, being properly subjected to arithmetical rules, produce results which are liable to few contingent errors, except those dependent on alterations in the prices of labour and materials which may generally be foreseen for short periods; the ordinary demand for building materials and workmen being so large that the increased demand for a new building is seldom sufficient to affect prices in any considerable degree. On the contrary, a survey of a large country occasions a new demand for surveyors, which is wholly unprovided for by the ordinary demands; it is a work of a lasting nature, allowing much time for alterations in price, and extending over a great space, where provisions and lodgings vary much in value. The number, extent, and intricacy of the lines to be surveyed, and the impediments to the progress of the survey, are unknown until the survey has been made. A very elaborate examination of the country gives but an imperfect guess at their probable amount.

With such impediments to accuracy, I feel desirous to save the public from the expense which the local examinations requisite to enable me to frame any probable estimates for a survey would cost, until the nature of the information to be required from that survey has been stated; the inquiries I should have to institute in the course of my tour being dependent on the nature of the survey required. If the boundaries of counties and parishes are not to be surveyed, it would be needless for me to examine them; if the scale is not to exceed an inch to a mile, it would be needless for me to pay any particular regard to the mineral districts, because such a survey would not answer the purposes required in them, and so on. Without a careful local examination I cannot frame an estimate, but I am anxious to afford the Government every information in my power. My letter of the 6th of May has detailed briefly the difficulties which have caused increased expense or deficiencies in the English and Irish surveys, and some suggestions for consideration respecting the Scotch survey. I may now add, that Scotland is not subdivided into small statistical spaces for local taxation, like the townlands of Ireland, and both the counties and parishes are generally large; the length of boundaries to be surveyed in Scotland must therefore bear a very small proportion to the length of boundaries which have been surveyed in Ireland. This would render the cost of laying down the statistical boundaries in Scotland very much less than in Ireland; and if no areas of public divisions are required in Scotland, this will be an additional cause for reducing the acreable cost of the Scotch survey below that of a survey of Ireland possessing an equal degree of accuracy. It may further be needful to remark, that the diminution of the scale on which the survey is to be laid down would not enable the surveyors to omit visiting every part of the country; and the difference of cost in the field-survey due to the difference between the scales of one inch or of six inches to one mile would depend on the judgment of the surveyors as to what particular details they might safely omit, and what inaccuracies they might safely admit for the smaller scale. This exercise of judgment would in many cases be freely used, and the examiners would have a trouble-

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some and invidious duty to perform in districts of an intricate nature; their expenses would be some drawback against the field saving of a smaller scale. In the drawing-room, the difference of cost due to difference of scale in the outline, plotting, and drawing would not be of sufficient amount to form any argument in favour of a scale inadequate for the purposes of the country.

Whenever the nature of the information required from the survey, and the particulars I have referred to as necessary are settled, and communicated to me, I will use my best exertions to frame comparative probable estimates of the cost which is likely to be incurred in carrying the survey into effect, and laying it down on either of the scales which have been adverted to. In the meantime, as parties for carrying on a detail map will be liberated from the Irish survey towards the close of the present year, I shall endeavour, without delay, to place an officer under Lieutenant Robinson, of the Royal Engineers, to proceed with the triangulation of Scotland, while he is conducting the principal triangles, that no loss of time might be experienced from want of fixed points after the detail surveyors enter Scotland. And I have further respectfully to state, that it will be expedient to have the scale and other legislative enactments for the survey of Scotland decided, before the estimates for the next year come under consideration.

Observations of the Inspector-General of Fortifications upon the foregoing Report.

As an Ordnance service embracing only the military question, I should not have thought it necessary to propose any reference to the scientific or other bodies alluded to in the Treasury letter of the 2d instant; but I conceive that Colonel Colby has very properly, in his former letter of the 6th May, requested attention to the subject of increasing the scale of the Ordnance Survey, as a standard authority upon which to base the general improvement and development of the civil resources of the country; and if Her Majesty's Government entertain the question under this view, I think it both desirable and necessary that they should consult those bodies or persons who are most competent in statistical and civil-engineering matters.

The acreable cost of the survey will depend upon the degree to which it may be thought proper to exhibit in it the information above alluded to; and I concur with Colonel Colby, that he cannot furnish an estimate of the comparative expense until that point shall be decided.

Inclosure 3 in No. 2.

COLONEL COLBY to the INSPECTOR-GENERAL OF FORTIFICATIONS.

Ordnance Map Office, July 11, 1840.

I have the honour to inclose a report proposing to carry on the survey of England and Wales, from the line coloured red on the accompanying index-map, to the northward, in such a manner that it may be laid down and engraved in outline upon a scale of six inches to one mile. This proposition will not involve the necessity for any additional grant during the present Parliamentary year; and it will cause very little delay in the progress of the maps, for an increase of force from the survey of Ireland may be calculated on next year.

The expediency of adopting the enlarged scale at as early a period as possible, is evinced by the demands for it in the mineral districts, and the obvious intricacy of the recent maps of the manufacturing part of the country, which require the aid of a powerful magnifier. In those parts of the map some names are unavoidably omitted; the rest are crowded into a small space in such small characters as to be hardly legible with the naked eye; and though these inch-scale maps are beautiful specimens of the skill of the engraver, they do not answer many of the most useful purposes of a national map. If the inch-scale map were continued over the rest of England by a reduction from the proposed six-inch outline maps, it would be unnecessary to crowd it with details, which would be better shown on the large sheets, and it would therefore be rendered less costly in engraving, and more useful for general purposes.

Observations of the Inspector-General of Fortifications on the foregoing Letter.

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ury and Ordnance
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I am of opinion that the crowding into a map of a scale of one inch to a mile, the details herein described, would be quite useless; and that if it be thought proper for the Ordnance Survey to furnish these details, the scale should be enlarged, as Colonel Colby suggests; and in that case the present appears to me the most favourable moment for making the alteration.

Report by Colonel Colby on the Survey of England and Wales, dated July 11, 1840, referred to in that Officer's letter of the same date.

In obedience to the Master-General's order, I have the honour to report specifically upon the survey of England and Wales, with reference to the facts detailed in my report of the 6th May last, relating to the proposed survey of Scotland. In that report I detailed many of the inconveniences and deficiencies due to the scale of one inch to a mile, on which the survey of England and Wales (having been designed originally for military purposes only) has hitherto been given. Its insufficiency for the purposes of public improvement has been shown by the costly parochial surveys which have recently been made for the settlement of the tithes, and by the numerous applications for surveys on a larger scale of the mineral and manufacturing districts, while the quantity of minute details, which the desire to render the maps as perfect as possible compels this department to crowd into small spaces in the map of the manufacturing and closely-peopled districts, becomes very costly, and renders the maps of those parts very indistinct. That the rapid progress of population and improvement will render a national survey of England and Wales on a large scale indispensable at no very distant period, there can be little doubt. The only question which at present seems to require decision is, whether the remaining part of the present national survey shall be carried forward, so as to be permanently useful in aiding the improvement of the country, or if it shall proceed on the insufficient scale of one inch to a mile only.

The survey of England and Wales on the scale of one inch to a mile has now proceeded to the line of sheets coloured red in the accompanying index-map, leaving the north of Lancashire, the north of Yorkshire, and the counties of Durham, Westmoreland, Cumberland, and Northumberland to be surveyed. This northern district contains much of the mineral and manufacturing part of Great Britain, in which an accurate map, on an adequate scale, for judging of the comparative merits of lines of new roads, for the insertion of watercourses, so intimately connected with the profitable working of the mineral fields, for laying down general bearings of mineral veins and strata, and having also numerous altitudes marked for reference, is essential to facilitate local improvements. The increased cost of making this survey and laying it down on a scale of six inches to one mile in outline would probably not exceed the cost of making it and laying it down as the English surveys are at present laid down, by more than one half. When engraved on copper on the six-inch scale it would form the basis of a permanent map, on which additional information could be readily engraved as fast as local alterations, arising from increasing population, manufactures, and commerce, rendered it necessary; whereas the revision of the map on the minute scale of one inch to a mile has been a very costly and unsatisfactory process, from the want of proper data for reference, and the crowded space on which the additions or alterations were to be inserted.

If the Government should decide on making the survey of the remainder of England on the scale of six inches to one mile, which would, without any further survey, form the basis for reduced maps on any smaller scale, the one-inch map might be continued, for the sake of uniformity, over the remainder of England, by a reduction from the six-inch scale outline map; but in that case less minutiae of detail than now given should be inserted on the inch-scale maps, because such details being more distinctly exhibited on the larger scale, for the use of those who wished to know them, it would be needless to increase

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the cost of drawing and engraving, and to render the inch-scale map so intricate as to require the aid of a magnifier by inserting them on it.

The want of an Act of Parliament to prevent the removal of the objects erected for the purposes of the survey has been one great impediment to the survey in England and Wales. I have sent one officer to the North of England to proceed with the refinding the positions of former stations in that country, and another officer into Wales for a similar purpose, it being essential to refine their positions accurately to proceed with the fixation of secondary points; and besides this present expense and delay, there were formerly in England and Wales frequent interruptions to the progress and accuracy of the triangulations arising from the wanton removal of the objects erected for observation from distant stations. It is no doubt true that the general progress of knowledge has materially diminished this source of expense and delay, but still the permanent preservation of objects for future reference can hardly be expected without some legislative enactment. The penalty to be inflicted for the removal of the objects used in the survey under the Act for the Survey of Ireland is only two pounds; and I am not aware of any instance in which it has been necessary to enforce it. The knowledge that a law existed for the preservation of the objects has been sufficient to prevent wanton or malicious injury, and the objects are not of a nature to obstruct any farming operation, or to be liable to any but wanton destruction. An Act of Parliament is also needful to provide the legal mode by which the boundaries of counties or parishes should be pointed out to the surveyors, and the mode in which damages unavoidably done by entering lands for the survey, should be assessed. When the triangulation rendered it impracticable in the lower parts of England and Scotland to avoid the selection of cultivated fields for stations, the estimation of the proper remuneration to be given for actual damages was most unsatisfactory and uncertain, and caused a loss of time greater than the value of the damage; few among the farmers appeared to have a correct notion of the injury which trampling on grass or young corn might have done, and there being no legal mode of assessing the value, the demands were guided almost solely by chance. In cases of gross extortion a neighbouring magistrate would give the public the advantage of recommending farmers to ask more reasonably, and in many cases the farmers were disposed to ask less than the real value of the injury their crops had sustained; but in Ireland, the Act for assessing damages in doubtful cases saves the time of useless inquiries and appeals.

The entrance of cultivated lands for the purposes of the survey is rendered necessary for the survey of rivers, streams, and watercourses, as well as the survey of the boundaries of counties or parishes. In the early contract-plan for the English maps, the surveyors neglected the survey of the lesser streams, to obviate the inconvenience of trespassing and to save themselves trouble; those maps on which the streams were mostly inserted by sketches from distant views, became, before they were revised, of very little use to the mineral surveyors or geologists, to whom the correct position of the streams and watercourses is the most valuable information a map can give.

The Act required to be passed during the next Session of Parliament for the survey of England and Wales would be extremely short; the prevention of the removal of objects erected for carrying on the survey, the power to enter lands, the mode of valuing unavoidable damages done in the course of the survey, and the legal mode of pointing out the boundaries of the counties and parishes which are legislative divisions to the Ordnance surveyors, being the only provisions required.

No additional grant for carrying forward this six-inch survey, prior to the expiration of the present parliamentary year, would be required; but an immediate decision is desirable to enable me to give instructions for surveying the portion of country I have already specified in such a manner that it might be plotted on the larger scale, whereas if the decision were delayed, a certain portion of this district would require to be re-surveyed whenever the larger scale should be imperatively called for by the progress of society.

No. 3.

The SECRETARY TO THE BOARD OF ORDNANCE TO SIR C. TREVELYAN.

Correspondence
between the Treas-
ury and Ordnance
in 1840.

Office of Ordnance, September 7, 1840.

I have the honour, by command of the Master-General and Board of Ordnance, to request you will bring under the notice of the Lords Commissioners of Her Majesty's Treasury the communication which was made to you on the 24th July last (M. 257), relative to the Ordnance Survey of Scotland; and that you will move their Lordships to have the goodness to favour the Master-General and Board with a reply thereto, at their Lordships' earliest convenience.

No. 4.

Treasury Minute, dated October 1, 1840.

My Lords read the correspondence which has taken place with the Master-General and Board of Ordnance, regarding the completion of the Ordnance Survey in England, and the extension of that survey to Scotland.

Read also a letter from the Duke of Wellington to the Chancellor of the Exchequer, in which his Grace has, at Mr. Baring's request, kindly communicated his opinion on the subject of the future operations of the Ordnance Survey.

They have likewise adverted to the memorials formerly received on the same subject from various public bodies, particularly to those received from the Highland and Agricultural Society of Scotland, from the Geological and Polytechnic Society of the West Riding of Yorkshire, and from the Geological Society and the Literary and Philosophical Society of Manchester.

The point of most vital importance which has to be decided is, the scale upon which the survey is hereafter to be conducted. The English Survey has hitherto been conducted upon the scale of two inches to the mile, which is reduced previously to publication to an inch to the mile. The Irish Survey is upon the scale of six inches to the mile. The scale of the English Survey is represented by Colonel Colby to be quite inadequate to the wants of the country, particularly in the mining and manufacturing districts, and he recommends that the scale of the Irish Survey, or six inches to the mile, should be applied to the districts in the north of England which remain unsurveyed, and to the whole of Scotland; in all which he is strongly supported by the Master-General and Board of Ordnance, by the public bodies above adverted to, and, as stated by the Board of Ordnance, by the general opinion of men of science and of consideration connected with the mining and manufacturing districts.

The additional cost of the increased scale cannot, it is stated, be accurately estimated, but it is believed that it will not exceed the present cost of the English Survey by more than one half.

My Lords are satisfied, from the consideration they have given to the subject, that the scale on which the English Survey has hitherto been conducted, falls much short of what is required by the existing circumstances of the country. That scale was originally fixed principally with a view to military considerations, while the demand of the present day is for such a national survey as shall be permanently useful in aiding the improvement of the country, by serving as a basis and guide in the formation of railroads, canals, and other public works, besides assisting in the development of the geological structure of the country, and promoting, in various other ways, the progress of science and statistical knowledge. Being of opinion, therefore, that if the nation incurs the cost of a survey, that survey ought to be of the kind which is admitted to be most generally useful, my Lords have no hesitation in giving their consent to the remainder of England and the whole of Scotland being surveyed on the Irish scale of six inches to the mile; and my Lords think themselves fortunate in having their opinion on this important subject confirmed by the concurrence of so high an authority as that of his Grace the Duke of Wellington.

By this means a permanent map will be obtained on a sufficiently large scale to admit of subsequent alterations and improvements in the face of the country being transferred to the map; and as, by placing this map at the disposal

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ury and Ordnance
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of private publishers, materials will be furnished to them for the construction of every description of maps on reduced scales suited to the public taste, it appears to my Lords that the interference of the State ought, as has been suggested by the Duke of Wellington, to stop at this point, and that it will not be necessary to put the public to the expense of having any other map engraved on a reduced scale.

With a view to determine the nature of the objects to be included in the survey, and the purposes to which it is to be rendered subservient, my Lords are of opinion that it will be convenient for the Master-General and Board of Ordnance to communicate direct with the Highland Society and with any other societies or individuals whom it may be thought proper to consult, and to report to the Treasury the conclusions to which the Board may arrive, with a particular statement of the additional expense which it would be necessary to incur in order to accomplish any desired objects which have not hitherto been included in the plan of the English and Irish Surveys. It will also be desirable that the Secretary of State for Home Affairs and the Lord Advocate for Scotland should be consulted as to the boundaries which it will be proper to survey with a view to their insertion in the map.

My Lords are also of opinion that it will be proper for the Master-General and Board to consider how far the expense of the detailed survey may fairly be expected to be defrayed from local contributions proportioned to the peculiar benefit which particular districts, societies, or individuals may be expected to derive from it; and they request that in case the Board of Ordnance should be induced, at the instance of any body of persons or individuals, to recommend that any additional object should be included in the plan of the survey which would not otherwise necessarily form a part of it, it may be particularly stated what degree of assistance the party at whose instance the addition to the survey is proposed to be made will undertake to contribute towards the accomplishment of the object.

A legislative enactment is stated to be required providing for the prevention of the removal of objects erected for carrying on the survey, the power to enter lands, the mode of valuing unavoidable damages done in the course of the survey, and the legal mode of pointing out the boundaries required to be surveyed: and as the preparation of such an enactment properly falls to the Master-General and Board of Ordnance, my Lords request that they will take the necessary steps for preparing it and introducing it in the next Session of Parliament. A single Act based on the corresponding legislative provisions relating to the Irish Survey will, it is presumed, suffice both for the unsurveyed portion of England and for Scotland.

Write as above to the Secretary to the Board of Ordnance, and transmit for the information of the Master-General and Board, a copy of the communication with which his Grace the Duke of Wellington has favoured my Lords on this subject.

Write to the President of the Highland and Agricultural Society of Scotland, the Directors of the Geological and Philosophical Societies of Manchester, and of the Geological and Polytechnic Society of the West Riding of Yorkshire, stating that my Lords have decided that the Ordnance Survey of Scotland shall be conducted on the scale of six inches to the mile, and that as the Master-General and Board of Ordnance have been requested to consider and report on the details of the work, any observations which the above-mentioned societies may have to offer in regard to the objects to be included in the survey and the purposes to which it may be desirable to render it subservient, should be directed to that Board, where they will be duly considered.

No. 5.

The DUKE OF WELLINGTON to the CHANCELLOR OF THE EXCHEQUER.

Walmer Castle, October 5, 1840.

I received on Saturday the papers which you sent me regarding the completion of the surveys of the counties in the North of England and in Scotland by the officers employed under the Ordnance.

One of these papers contains the report, by Colonel Colby, of the origin and progress of these surveys and their existing state, and some interesting details on the origin, progress, and existing state of the survey of Ireland.

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ury and Ordnance
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The perusal of this paper will show how important it is to fix and define exactly, before the survey is commenced, what are the objects on which it is desired to obtain information, and to which it is intended to apply the same when obtained.

A map or plan upon the largest scale, with the most minute detail, would be absolutely necessary in counties in which statistical and topographical information are required for fiscal purposes; as in France and other foreign countries, for the applotment of fiscal as well as of local taxation; and in Ireland, for the applotment and levy of the grand jury and other local cesses, in counties, baronies, and other localities.

Such minute information is not necessary in England or Scotland for these purposes. Other modes have been discovered, and are in use, for applotting each district of the country, and for levying the assessment required from each under the operation of the laws applicable thereto.

But it is obvious that surveys of all parts of the country, conveying the most minute topographical information, would be very desirable to the country at large, as well as to science and to individual proprietors, and even to Government itself, although not for fiscal purposes.

The most minute topographical information must be desirable in all the departments connected with the administration of the affairs of the Army and Ordnance, and, indeed, in all the departments of the Government.

It is impossible that it should not be perceived how desirable detailed topographical information would have been to the administration, as well as to Parliament, to enable its members to consider with advantage the various schemes proposed for carrying into execution the construction of lines of railroad throughout Great Britain. It cannot be doubted that much expense would have been avoided, if only in litigation, as well as much inconvenience, if Government could, ten years ago, have had information to enable them to consider the construction of railroads as a whole, and to consent to their extension to all parts of the country, if such accurate information should have shown that they were required, or to prevent their extension when not required excepting for the purpose of promoting the schemes of jobbers in shares.

The memorials among the papers state the interest felt by different associations that the surveys to be made in future may contain the most minute topographical information. There can be no doubt of the interest which all proprietors of land must feel in obtaining information of the same character; and I advert to this point, because the public have already derived the advantage of the assistance of individual subscribers to defray a part of the expense of the comparatively defective surveys heretofore made of some of the counties. It cannot be doubted that the scientific and other associations in different parts of the country, as well as the proprietors of land in general, would readily engage to take the maps and plans, the result of the labours of a detailed survey carried into execution with science, conveying all the topographical information necessary for the transaction of the business of the country.

Such information cannot to a certainty be given upon maps or plans of smaller dimensions than six inches to a mile; and even if there was not a prospect, or even certainty, that a large part of the expense would be defrayed by the subscriptions of associations and individuals, I would recommend that the Government should decide the question discussed in these papers in conformity with the suggestion that the plans and maps should be constructed upon a scale of six inches to a mile; seeing that the expense of a survey, so minute as such a map or plan would require, would not exceed half of the expense in addition to that of forming a plan upon the reduced scale of one or two inches to a mile; at the same time that the use of the larger scale would render practicable hereafter the correction of errors, or the insertion in the map or plan of any new road or other altered feature made on the surface of the country since the confection of the map.

These maps and plans should contain, besides the topographical information given in all maps, such as lines of road of all descriptions, railroads, canals, rivers, stating whether navigable or otherwise, and for vessels of what size and description, other features of the country, such as towns, villages, hamlets,

Correspondence
between the Treas-
ury and Ordnance
in 1840.

the noted seats and parks of noblemen and gentlemen. The distinction of land covered with wood from other, describing the shape of the wood. These maps should indicate the general relative elevation of the country surveyed, and represented either by shadows or by numbers. The political division and boundaries of the country, such as parishes, hundreds, counties, and others locally known, should be accurately ascertained and marked; and the boundaries of corporations and towns, whether fixed by custom or by Act of Parliament.

The Government would of course consider to what objects the attention of the officers directing the survey should be directed, and upon what subjects information was required, whether geological or other, in addition to those above referred to, when orders should be given to commence the survey of any particular county or district of the county.

The officer directing the survey should, besides, be authorized to extend its labours to other objects, if he should find it expedient or necessary, upon finding that such information as he can procure and insert in the map would be generally useful or is desired by numerous or influential classes of the population, and can be attained and inserted in the map without materially increasing its expense or occasioning delay in its completion and publication.

I have stated my expectation that a great part of the expense of this work will be defrayed by the contributions of local associations and individuals. I am perfectly aware, however, that the most complete of these maps will not relieve any proprietor of land from the necessity of procuring a survey of the estate in his own possession, giving still more minute and detailed information. The same statement may be made in respect to roads, railroads, questions of commutation of tithes, and others, upon which the settlement depends upon accurate topographical information. It must not be supposed, therefore, that these surveys will convey a great advantage to the proprietors of land.

I do not recollect that there is any other point upon which it might be desirable to you to have my opinion, besides those to which I have adverted, excepting the formation of a map upon a smaller scale, such as three miles to an inch, for general use, reduced from these accurate surveys on the large scale. Such maps would, undoubtedly, be generally useful, and the construction and sale of them might provide for a part of the expense of the survey. But I confess that I should prefer to leave to the trade the execution and sale of these maps, and to limit the attention of the officers of the Ordnance to the production of the most complete and satisfactory topographical work yet produced on the scale proposed, as most likely to be the most convenient to the Government, to the public, and to all classes of persons interested in the existence and possession of such a work.

Memoranda and Correspondence respecting the relative advantages of the Six-inch Scale and a still larger one.

Memoranda
and
Correspondence.

No. 1.

MEMORANDUM by the HONOURABLE MR. CHARTERIS.

February 10, 1853.

In 1851, a Committee of the House of Commons, of which I was Chairman, was appointed "to inquire into and report on the present state of the Ordnance Survey of Scotland, and on the works which will be required for its completion."

It appeared in evidence that the principal triangulation of Scotland was commenced in 1809, discontinued in 1823 (the staff and instruments having been transferred to Ireland), and was again resumed in 1838. So slow, however, had been the progress made, so limited had been the sums of money voted and appropriated for the purposes of the survey, that only one-sixtieth of the whole of Scotland had been published, and that, unless the annual grant was increased, and the progress of the operations accelerated, fifty years must elapse before the work could be completed; whilst the Irish Survey, which was commenced in 1824, had been completed and published, on the six-inch scale, in 1846, at a total cost of 820,000*l.*; and the whole of England, with the exception of the six northern counties, had likewise been surveyed and published, on the scale of one-inch to the mile, at a cost of 750,000*l.*

This scale of one inch to the mile was originally adopted for the publication of the Ordnance Map of Great Britain. The first departure from it was made in consequence of the recommendation of the Committee which sat upon the Irish Survey in 1824, under the Presidency of Lord Montecagle, and which reported in favour of the Survey of Ireland being made by townlands on the scale of six inches to the mile, as the one-inch scale was not sufficiently large to admit of the insertion of the townland boundaries and other territorial divisions, which were required for the purpose of making a valuation which was in future to serve as the basis of local assessments.

The recommendation of the Committee was adopted by Government, and the Survey of Ireland, on the six-inch scale, was immediately commenced. It would appear, however, that at that time there was no intention of engraving or publishing the survey on the six-inch scale, or of extending it to Scotland or to England. The engraving of the six-inch survey appears, according to Mr. Griffith's evidence, to have resulted from his having required four copies for valuation purposes, when it was found that it would be as cheap to engrave it as to make that number of copies.

The six-inch scale having thus been adopted in Ireland, memorials were presented to Government, from various quarters, praying that it might be extended to Scotland and to the six northern counties of England, which was done in accordance with a Treasury Minute to that effect (see Sir C. Trevelyan's evidence before the Irish Committee, 1846, page 3), and the one-inch map was accordingly abandoned.

The foregoing is a short account of the progress and state of the Scotch Survey, at the time when the Committee upon it was appointed in 1851.

Experience of the Irish maps on the six-inch scale having shown that, whatever may be their value, a one-inch map is, for general purposes, absolutely essential, the Committee directed their attention to the comparative value of these two scales in reference to Scotland.

It appeared that the map of Scotland on the six-inch scale, completed and put together, would occupy a space of 216 feet by 126. The county of Wigtown would be 24 feet by 20.

When, therefore, the cumbrous size of a map on this scale is considered, and when it is borne in mind that it has no shading by which physical relief is depicted, it will readily be perceived that, for purposes of general consultation, a map of this description is practically useless, and cannot possibly convey to the mind as accurate an impression of the general character of a country as is supplied by the one-inch Ordnance Map of England. Messrs. Brunel, Stephenson, and Locke, who were examined before the Committee, have borne the strongest

testimony to the superior value of the one-inch map, which, they state, enables them, in laying down a line of railway between places of 100 or 200 miles distant, to see at a glance the course it ought to take, thereby saving the expense and delay of a primary exploration of the ground, which in the absence of such a map would have been rendered necessary. On the other hand, the size of the six-inch map renders it impossible to embrace so wide a field at one view; whilst, as has been before stated, from the absence of shading and relief, it does not convey to the mind, at a glance, any general idea of the character of the country, whether mountain or plain, through which the line will have to run.

What applies to experienced engineers in laying down a long line of railway applies naturally, with still greater force, to country gentlemen and road trustees, who, in the absence of a one-inch map, might find themselves obliged to lay out a road from one part of their county to the other on a six-inch map.

Six-inch maps would, indeed, appear to be either too large or too small. For the general purposes for which maps are ordinarily used they are unquestionably too large; for plans of estates, and for most civil purposes, they are as unquestionably too small, estates being generally mapped on the scale of three chains to the inch (equal to $26\frac{2}{3}$ inches to the mile, or more than four times the size of the six-inch scale), which, it must be remembered, was not originally adopted as the scale best suited for all the local and civil purposes to which a detailed and accurate survey is applicable, but solely as a scale sufficient for the insertion of the townland boundaries in Ireland which were required for the purpose of making a valuation. It must likewise be remembered that it was extended to Scotland and to the northern counties of England without sufficiently considering how far it was suited to the local peculiarities, social condition, and territorial divisions of those countries.

Sir John Macneill, who, as a civil engineer, has had considerable experience of the six-inch Irish maps, stated to the Committee that, if an accurate plan for property purposes were wanted, the scale of six inches to the mile would still be insufficient, and that he wished a larger scale had been adopted in Ireland.

The supposed accuracy of the six-inch survey being the chief, if not the only, argument in its favour, it becomes a grave matter for consideration how far Parliament is justified in sanctioning the expenditure of large sums of money upon the publication of maps or plans which a witness, favourable to the six-inch scale, describes as being too small, if accuracy is required.

In considering, moreover, how far the six-inch scale is applicable to Scotland, the peculiar character of the country must not be lost sight of, as more than two-thirds of it are barren, rugged, and precipitous, and, consequently, ill adapted for a map on a large scale, which is only of value in so far as it admits of fences and other minute subdivisions being given, which cannot be rendered on the scale of one inch to the mile.

It would, therefore, be the height of absurdity to survey the highlands and the barren wastes of Scotland on a large scale, as the maps of those districts would be mere blank sheets of paper, with a few figures dotted over them here and there to denote the different altitudes, and presenting an appearance similar to Sheet 11, County Wicklow, to be found in the Library of the House of Commons.

It appeared that the estimated cost of the map of Scotland on the six-inch scale was 750,000*l.*, whilst it was shown to the satisfaction of the Committee that a one-inch map might be published at a total cost of 250,000*l.*, and might be completed in ten years, if 25,000*l.* were annually voted for the purpose.

The Committee, therefore, after a careful review of the evidence, taking all these circumstances into consideration, recommended the abandonment of the six-inch scale, as not being of sufficient public utility to justify the large expenditure of public money which it requires, and as being inapplicable to two-thirds of Scotland; and they urged upon Government the speedy completion of a one-inch map, shaded and engraved like the one-inch map of England.

The report of the Committee was dated July 10, 1851. On the 21st of October following a Treasury Minute was issued, adopting the recommendations of the Committee, but referring to the Master-General and Board of Ordnance for their opinion. On the 28th November, by command of the Board of Ordnance, Mr. Butler forwarded to the Treasury, along with other documents relating to this subject, a report from Lieutenant-Colonel Hall, the superintendent of the Ordnance Survey, and expressed, on the part of the Master-General and Board, their entire concurrence in the view taken of this important question by

the Inspector-General of Fortifications, Sir John Burgoyne, and by Lieutenant-Colonel Hall. The Inspector-General of Fortifications is of opinion "that the advocates of the small scale have greatly undervalued the utility of the larger map, which has been very eminently useful in Ireland in very many ways, though still the case may not apply to Scotland or England. It is a very important matter, and he presumes full consideration will be given to the subject, before a final decision is given upon it."

Lieutenant-Colonel Hall, in his Report, impugns alike the wisdom and soundness of the Committee's recommendation with respect to the six-inch scale; regrets that they were not inclined to receive evidence from other engineers than those examined; incloses a letter from Mr. Vignoles, civil engineer, in favour of the six-inch scale, and observes that the Committee was almost entirely composed of non-professional men, and that the question of a proper scale for a national survey is of a professional nature. Colonel Hall recommends, if Her Majesty's Treasury are not disposed to permit the survey of Scotland to be continued on the six-inch scale, that General Colby's original proposition be adopted, viz., to map the mineral, manufacturing, and improvable districts of Scotland on the six and one-inch scales, and the highlands and unimprovable districts on the one-inch scale only. Several letters from civil engineers and others, in favour of the six-inch survey, accompanied this report.

In answer to Colonel Hall's statement, that "the Committee were not inclined to receive evidence from other engineers than those examined," I have to remark that, before proceeding to draw up the Report, I asked Colonel Anson, who, as Clerk of the Ordnance, represented that Department on the Committee, whether he had any further evidence to adduce, and it was only on his replying in the negative that the evidence was closed.

With reference to Colonel Hall's objection to the constitution of the Committee, as being composed of non-professional men, I have to state that Mr. Locke, the engineer, was a member of the Committee, and that the question of scale is one upon which professional knowledge is not indispensable in forming a sound opinion.

On the 16th December, 1851, a Treasury Minute was issued, in accordance, I believe, with the instructions of the then Chancellor of the Exchequer, Sir C. Wood, in which their Lordships refer to Colonel Hall's Report, &c., and express an opinion that, inasmuch as the survey of certain counties in England and Scotland had been begun, and partly published, on the scale of six inches to the mile, the survey of those counties should be completed on the same scale, and according to the same arrangements in other respects as are now in force, but that no expense should be incurred for the survey of other counties until this important subject shall have received more full consideration.

The counties, the survey of which had been commenced and partly published on the six-inch scale, and which, in accordance with the above minute, were to be completed on the same scale, are,—Wigtown, Kirkcudbright, Edinburgh, and the Island of Lewis, in Scotland, and Lancashire and Yorkshire, in England.

During the period that the late Government were in office, memorials (a list of which I inclose) were forwarded to the Treasury from many of the counties, burghs, and public bodies in Scotland, praying for the continuance of the six-inch scale, and the Government accordingly sanctioned the publication of a survey, on the six-inch scale, of the counties of Haddington and Fife, in Scotland, and of the county of Durham, in England.

Such, then, is the position in which this question now stands.

My own opinion as to the soundness of the views of the Committee of 1851, which recommended the abandonment of the six-inch scale, and the speedy completion of a one-inch map, remains unchanged; and it must not be forgotten, not only that the Committee were unanimous, but that out of fifteen members of whom it was composed, eleven were Scotchmen, who are in general tolerably capable of forming an opinion as to what is likely to be beneficial to their country. An agitation, however, has taken place in Scotland, for the purpose of obtaining the continuance and extension of the six-inch scale, as is evidenced by the memorials to which allusion has already been made. The question, therefore, now to be considered is, how far it will be wise and politic to yield to this agitation, and to grant the prayer of the memorialists. My own opinion is, that too much has already been conceded to admit of our withholding still further concessions.

We must remember that as the case now stands in Scotland, the counties of Wigtown, Kirkcudbright, Edinburgh, Haddington, and Fife, and the Island of Lewis, are to be published on the six-inch scale, and that of the six northern counties of England, the survey of which is not completed, Lancashire, Yorkshire, and Durham are to be published on the large scale. These concessions which have been made, and which are regarded as a favour, cannot be withdrawn, and I confess I do not see how in justice still further concessions can be withheld. In the case of Haddington, Fife, and Durham, the rule laid down by the Treasury Minute of the 16th December, has been broken through; as it gave instructions that the survey of those counties only which had been partly published should be completed on the six-inch scale. Now, although four-fifths of the county of Haddington had been surveyed on the large scale, no portion of the survey had been published; and as regards the counties of Fife and Durham, the survey had not even, I believe, been commenced at the time the Treasury Minute was issued. I find, on referring to a return from the Ordnance Map Department, which is amongst other papers on this subject at the Treasury, that the survey upon the six-inch scale, though not now in progress, had been likewise commenced in the counties of Dumfries, Ayr, and Linlithgow; and as these counties have memorialized Government with a view to obtaining the completion of their surveys on that scale, it cannot, I think, be refused to them.

If, therefore, this further concession is made, the survey of more than one-fourth of the counties of Scotland will be completed and published on the six-inch scale, and I cannot see on what principle it can be withheld from those counties which have petitioned or which may hereafter petition for it. It would, however, be most absurd, as I have before endeavoured to show, to extend the six-inch scale to the barren wastes and rugged mountains of Scotland, amounting to two-thirds of the whole, and I should therefore feel disposed to advise the adoption of the recommendation which was originally made by General Colby, and which is contained in Lieutenant-Colonel Hall's Report, viz., to confine the large-scale survey to the mineral, manufacturing, and *cultivated* districts. I have substituted the word *cultivated* for *improvable*, which occurs in Colonel Hall's Report, as the line of cultivation is clear and definite, whilst *improvable*, as applied to land, is a term so vague and undefinable that it would lead to endless dispute and confusion.

750,000*l.* being the estimated cost of a six-inch map for the whole of Scotland, by thus limiting that scale to the cultivated districts a saving of one-third, or 250,000*l.*, would be effected.

Supposing, then, the six-inch survey to be extended to the cultivated districts of Scotland, it is, I think, only just and reasonable, in consideration of the great national importance of the work, and of the dilatory manner in which it has hitherto been conducted, that such grants should be made for the purposes of the survey as will lead to its speedy completion, and at the same time the publication of the one-inch map, as recommended by the Committee, should be proceeded with as rapidly as possible.

In considering the question of the survey of Scotland, I have confined myself to the only two scales in reference to which the Committee of 1851 directed their inquiries: before, however, I conclude my remarks upon this subject, I would urge the propriety of considering whether it might not be advisable to survey and map the cultivated districts of Scotland *upon a much larger scale* than six inches to the mile.

The six-inch scale I have already endeavoured to show is neither one thing nor the other; it is too large for a general map, it is too small to enable all the boundaries, minute details, and subdivisions, to be clearly given, which are required for an accurate plan of an estate and for most civil purposes. Yet in all the arguments which before the Committee of 1851 have been adduced in its support, it has been assumed to be sufficient for all the purposes for which a map on a larger scale can at any time be required.

Colonel Hall, in the report to which reference has already been made, calls attention to the considerations brought under the notice of the Lords Commissioners of Her Majesty's Treasury by the late Master of the Rolls, Lord Langdale, in his letter of the 30th November, 1848, a copy of which he incloses; and he remarks, that if the Ordnance Survey of Scotland is limited to the one-inch map, every new requirement that may arise in Scotland for maps on a large scale will, as pointed out by Lord Langdale, require an additional survey to be made for the occasion, to be paid for by the community then requiring it.

Lord Langdale, in the letter referred to, suggests the propriety of taking into consideration the importance of public maps and surveys, and of making them if possible subservient to the various public purposes for which they are required; and amongst these purposes he more especially refers to poor-law valuations under 4 & 5 Wm. IV. cap. 76, sec. 35; to the commutation of tithes under 6 & 7 Wm. IV. cap. 71, secs. 34, 53, 59, 7 Wm. IV. & 1 Vict. cap. 69, sec. 1, 2 & 3 Vict. cap. 62, sec. 22, 5 & 6 Vict. cap. 54, sec. 13; to parochial assessments under 6 & 7 Wm. IV. cap. 96; and to sanitary improvements under 11 & 12 Vict. cap. 63.

These Acts, he says, "show only *some* of the many great and important purposes for which good and accurate maps are required." "Unfortunately," he adds, "the surveys made, and in progress, have been made under separate and distinct authorities, each for its particular purpose, without any regard to the other important purposes for which maps are wanting; and in almost every case in which maps are wanting for a purpose not before contemplated, it is found that maps previously constructed at great expense are inapplicable, or not well adapted to the new purpose; and thus, for instance, it happens that if the Commissioners now engaged in considering the questions relating to the registration of deeds, or assurances of land, should report public maps to be necessary for the establishment of a good system of registration, it is doubtful whether any of the public maps already made could be employed for the purpose."

This letter of Lord Langdale's having thus been brought forward by the advocates of the six-inch scale, we are doubtless meant to infer that maps upon that scale will be sufficient for all the purposes to which reference has been made, or for which a necessity may hereafter arise; but so far from this being the case, as I am informed, there is no one purpose mentioned in Lord Langdale's letter to which maps on the six-inch scale can with safety and convenience be applied.

The scale which it would appear is best adapted for a survey suited to all civil purposes, is three chains to an inch, equal to $26\frac{2}{3}$ inches to the mile, and this, for engraving and publication, might, it appears, be reduced to a scale of 12 inches to the mile. This scale of three chains to an inch was recommended by the Tithe Commissioners, in a letter dated the 18th of February 1837, to the then Chancellor of the Exchequer, Mr. Spring Rice, as the scale best adapted for the maps to be used for the commutation of tithes. They say "that, unless the contents of fields can be computed from the map itself, and compared with the book of reference sent with it, there is no real security for the correctness of either of those documents." The Commissioners then state, "that they have a clear opinion, strengthened by the concurrence of a very great majority of the practical surveyors they have consulted, that, taking the country throughout, a scale of three chains to an inch is the smallest which can be safely relied on for such computations, and they therefore recommend that scale for general adoption." This recommendation was in a great measure based upon the report of Lieutenant (now Major) Dawson, engineer to the Tithe Commission, which accompanied the letter to Mr. Spring Rice, and to which they call his attention; and in proof of the inapplicability of the six-inch maps to the purposes of the tithe commutation, I may mention that, within a very recent period, as I am informed, the Ordnance officers have made for the Tithe Commissioners, maps on the three-chain scale, of more than twenty parishes in Lancashire and Yorkshire, the survey of which had already been undertaken by the same officers on the six-inch scale.

The foregoing arguments I cannot but think conclusive against the general adequacy of the six-inch scale; but there is one great question to which Lord Langdale refers in his letter which is immediately connected with this subject, and to which, at the present moment, when the public are fully alive to the great importance of legal reforms, I would more particularly allude; viz., "the facilitating the transfer of land."

In 1847, a Committee was appointed "by the Law Amendment Society" to "consider the propriety of making a general map of the lands of England and Wales, for the purposes of registration and conveyance and otherwise, and to ascertain what steps have been taken, and what materials are forthcoming, for making such a map." In their report they say, "that the propriety of making such a general survey and map of the kingdom as that described in the above reference, has from time to time been recommended to the Legislature by Committees of both Houses of Parliament, and by other parties whose knowledge

and experience entitle their opinions to respect ; and that they feel disposed to concur in the opinion, that the purposes which would be served by such a map are: The providing the Government and the community with such accurate information as to the extent, the character, and the division of the surface of the country as might facilitate the conveyances of real property, the administration of justice in disputes concerning boundaries, and, generally, the rendering more accurate and more easy all transactions affecting the land of the country, either as between individuals or as between the Government and the public." Economy, simplicity, and certainty, they say, require that every plot or parcel of land shall be delineated and identified upon a public map ; which map shall be accompanied by a regular description of such needful particulars in reference to each parcel as cannot with convenience be given upon the face of the map itself. The scale which, upon inquiry, they find would be sufficient for this purpose, is six chains to the inch (equal to $13\frac{1}{3}$ inches to the mile) ; in towns, however, a scale of less than one chain to the inch, or 80 inches to the mile, would not be sufficient.

With reference to the cost of a map of this description for England, the Committee, after taking into consideration the Tithe Commutation Maps already existing, and which can be made available for the general survey, came to the conclusion that a general map of the rural districts of England, upon the scale of six chains, and of the towns and populous districts upon that of one chain to the inch, could be completed at a cost of 645,000*l*.

Since the period, however, when this report was published, a considerable extent of country has been mapped by the Tithe and Inclosure Commissioners, and the survey of the northern counties of England has been progressing on the six-inch scale, which might likewise be made available for this larger general survey, and which would probably greatly reduce its cost.

The Committee of the Law Amendment Society, in addition to the facilities which such a map would offer for the transfer of real property, point out its applicability to an improved system of local taxation, as well as to the formation of efficient arrangements for the collection of agricultural statistics (a subject which has within the last week been taken up by the Government), and to these they might have added, drainage and inclosure of land.

It thus appears that a map on the scale of 12 inches to the mile, which would be applicable for all those civil purposes to which reference has been made, might be completed and published at a cost so trifling, in comparison with the public benefit to be derived from the survey, as fully to justify such expenditure ; more especially when we consider that, in all probability, as soon as the six-inch survey of the six northern counties of England is completed, the remaining counties will not unreasonably claim to have it extended to them likewise. As regards the cost of an enlarged survey of the cultivated districts of Scotland, it will, I have reason to believe, be found upon inquiry, that it might be made upon the 24-inch scale, and published upon a scale of 12 inches to the mile, for a sum considerably less than the estimated expenditure for the survey of the whole country upon the six-inch scale.

Taking, therefore, all these things into consideration, I would strongly urge the necessity of a fuller inquiry into this important subject before a further expenditure of public money is sanctioned upon the six-inch survey, which can lead to little public benefit.

At the same time, it would be advisable to consider how far the scale of 5 feet to the mile, adopted by the Ordnance for the survey of towns, is sufficient for sanitary purposes, as it will, I believe, appear that the Board of Health have, in many cases, been unable to use the Ordnance Maps, and were obliged to have a fresh survey made upon the scale of 10 feet to the mile.

In conclusion, I would urge the importance of putting an immediate stop to the system of contouring.

Contouring consists in the ascertaining on the ground, and representing upon the map, level lines, of equal altitude, at certain vertical distances apart, measured from a certain datum plane coinciding with the mean level of the ocean. It is a very costly process, the estimate for the whole of Scotland being 120,000*l*., or 4*l*. per square mile.

The Committee of 1851 entered fully into the subject, and unanimously recommended its abandonment as being of no real practical use.

No. 2.

Memoranda
and
Correspondence.*Abstract of recent Applications to the Treasury, relating to the Ordnance Survey.*

1851.

Name.	Date.	Object.
Ayr, Town Council of - -	February 12,	Speedy completion of Ordnance survey of Scotland.
St. Andrew's, Town Council of -	„ 13,	Ditto, on a sufficiently extended scale.
Cupar, Fife, Town Council of -	„ 14,	Ditto.
Aberbrothwick, Town Council of -	„ 15,	Ditto.
Greenock, Chamber of Commerce of	„ 25,	Ditto.
Inverness, Town Council of - -	„ 27,	Ditto.
Royal Society of Edinburgh - -	„ 30,	Ditto.
Perth, Town Council of - -	March 6,	Ditto.
Aberdeen, Provost, &c., of - -	„ 31,	Ditto.
Edinburgh, Royal Physical Society of	April 4,	Ditto, the drawings of the survey to be on the large scale, but the published maps on the 1-inch scale, shaded or contoured.
Highland and Agricultural Society of Scotland.	„ 7,	Ditto.
Linlithgow, Town Council of -	„ 10,	Ditto.
Royal Scottish Society of Arts -	„ 14,	Ditto.
Glasgow, Philosophical Society of -	„ 26,	Ditto.
Inverness, Commissioners of Supply of	„ 30,	Ditto.
Forfarshire, Commissioners of Supply of.	„ 30,	Ditto, reduction to 1-inch scale on publication, shaded and contoured.
Edinburgh, Geological Society -	May	Ditto.

1852.

Dundee Harbour, Trustees of -	May 31,	For completion of survey of Scotland, on 6-inch scale.
Cupar, Town Council, &c., of -	June ,	For 6-inch contoured survey of county of Fife, with maps of towns on large scales.
Royal Burghs of Scotland, Convention of.	„ ,	For completion of survey of Scotland, and publication of the maps on 1-inch scale.
Fifeshire, Commissioners of Supply of	„ 15,	Ditto of Fifeshire, on 6-inch scale.
Dundee, Town Council, &c., of -	„ 24,	Ditto of Scotland, on 6-inch scale.
Trafalgar Agricultural Society, Fifeshire.	„ 26,	For completion of survey and publication of the maps; both a 6-inch and 1-inch map of the county.
Perth, Town Council of -	July 5,	Speedy completion of survey of Scotland, on 6-inch scale.
Kirkaldy Agricultural Society, Fifeshire.	„ 7,	Ditto of Fifeshire.
Kinglassie Agricultural Society, Fifeshire.	„ 17,	Ditto, with both a 6-inch and 1-inch map.
Newburgh, Fifeshire, Town Council, &c., of.	„ 19,	For a 6-inch contoured survey and map, with large maps of the towns.
Haddingtonshire, Landed Proprietors, &c., of.	August 3,	For survey of East Lothian, on 6-inch scale.
Dunfermline, Town Council, &c., of	„ 20,	For survey of county of Fifeshire on 6-inch scale, with 5-feet scale for larger towns.
Durham, Magistrates of the County of.	September 9,	For survey of county on 6-inch scale.
Argyllshire, Commissioners of Supply of.	„ 29,	For survey of county on 6-inch scale, with contour levels.
Portobello, Town Council, &c., of -	October 1,	For survey of the Burgh of Portobello, on scale of 5 feet to the mile.

1852—continued.

Name.	Date.	Object.
Newcastle-upon-Tyne, Borough of -	October 7,	For survey of counties of Durham and Northumberland on 6-inch scale.
Kincardineshire, Commissioners of Supply of.	„ 15,	For survey on 6-inch scale, the maps, except in special cases, to be engraved on the 1-inch scale.
Kinross, County, Commissioners of Supply of.	„ 20,	Ditto.
Ayrshire, Commissioners of Supply of.	„ 22,	For survey of the County of Ayr on 6-inch scale, with maps both on the 6-inch and 1-inch scale.
Edinburgh, Chamber of Commerce, &c.	„ 22,	For survey of Scotland on 6-inch scale.
Stockton Ward, Durham, Landowners of.	„ 25,	For adoption of 6-inch scale in survey of County of Durham.
Clackmannan, Sheriff, &c., of - -	„ 26,	For survey of county on 6-inch scale.
Sunderland, Town Council, &c., of -	November ,	For survey of Durham county on 6-inch scale.
Berwick, Commissioners of Supply of	„ ,	For survey of county on 6-inch scale.
Dumfriesshire, Commissioners of Supply of.	December ,	Ditto.

1853.

Glasgow, Philosophical Society of -	January 26,	For survey of counties of Lanark, Ayr, and Renfrew on 6-inch scale, the levels marked by figures and contoured.
Sanquhar, Town Council, &c., of -	„ 31,	For survey of town of, on large scale of 5 feet.
Lanarkshire, Commissioners of Supply of.	February 4,	For completion of survey of county on 6-inch scale.
Perth, Town Council of - -	„ 7,	Ditto.
North Berwick, Council of - -	„ 12,	For survey of the burgh on the scale of 5 feet to the mile.
Pittenweem, Town Council of -	„ 15,	For completion of survey of the Burgh on scale of 5 feet to the mile.
Royal Burghs of Scotland, Convention of.	„ 15,	That plans of the Royal and Parliamentary burghs, &c., of Scotland, be made on 5-feet scale.
Glasgow, Town Council of - -	„ 18,	For a survey of county of Lanark on 6-inch scale, and for city of Glasgow on 10-feet scale.
Ayr, Town Council of - -	„ 21,	For publication of maps of county of Ayr on 6-inch scale, the levels marked by figures and contour lines.
North Berwick, Magistrates and Town Council of.	February ,	For the survey of the burgh on the scale of 5 feet to the mile.
Irvine, Magistrates and Town Council of.	March 3,	For survey of the counties of Renfrew, Lanark, and Ayr, at 6 inches to the mile, with contour lines, &c.
Paisley, Provost, &c. -	„ ,	For survey of the town at 10 feet to the mile, and of the counties of Lanark, Ayr, and Renfrew at 6 inches, with contour lines, &c.
Linlithgow, Commissioners of Supply, &c.	„ ,	For survey of the county at 6 inches to the mile.
Kilmarnock, Provost, &c. - -	„ ,	For survey of the counties of Lanark, Ayr, and Renfrew at 6 inches to the mile, with contour lines, &c.
Glasgow, Philosophical Society -	„ ,	For survey of the town at 10 feet to the mile.
Maybole, Magistrates, &c. - -	„ ,	For the immediate resumption of the survey of Ayrshire, on all the three scales of 1 inch and 6 inches for the country, and 5 feet for the towns.
Lanark, Provost, &c., of -	April ,	For survey of Lanarkshire on the 6-inch scale, with contour lines, &c., and of the burgh of Lanark on the corresponding scale for towns.

No. 3.

Memoranda
and
Correspondence.

SIR C. TREVELYAN to MAJOR LARCOM, R.E.

February 22, 1853.

Be so good as to assist us with your experienced judgment on the following points.

1st. Is the six-inch scale of the Irish survey sufficiently large for the various purposes to which a national survey is applicable?

2d. If we had to make the Irish survey over again, what scale would, all things considered, be the best? And,

3d. What scale do you recommend for the northern counties of England, and the lowlands of Scotland?

I will thank you to consult Mr. Griffith before you send me your answer, and to let me know how far he agrees with you, and what his opinion is on the points (if any) on which he differs from you.

No. 4.

MAJOR LARCOM, R.E., to SIR C. TREVELYAN.

Dublin, March 2, 1853.

The six-inch scale has fulfilled all the purposes to which it has been applied in Ireland; and if we were beginning again, I do not know that we could choose a better.

I know it is said by those who oppose its adoption in England and Scotland that it is not large enough for an estate map, and too large for a general map and this to some extent is true—but it is not meant for either.

Its peculiar applicability is to those purposes which require *detailed local topography for public objects*, such as valuation for county and poor rates, drainage, arterial and thorough, laying-out roads, and the like. It is also perfectly suited to land registry, as a map index. It was of inestimable value in reconstructing the poor-law unions and electoral divisions; which you can only imagine for England by supposing you had to reconstruct all your 12,000 parishes, making them equipollent in regard to area, value, and population combined, and making their boundaries boundaries of property also. Neither a smaller nor a larger scale would have enabled us to effect this. A smaller would not have exhibited the internal boundaries; a larger would not have shown the grouping and comparison. The same remarks apply to the census, the agricultural returns, and the police districts, and the districts of petty sessions. Maps for these purposes require more detail than a general map would afford, but must not be too large to present a considerable tract of country to the eye at once.

I think the objectors to this scale are generally persons who use or require the maps but for one purpose, for which some find them too large, some too small; and, on the other hand, its advocates claim too much for it, by supposing, what is impossible, that it renders all other scales unnecessary; while there are very few people who have applied them to various purposes. The truth is, and it is idle to shut our eyes to it, no one scale can subserve all purposes; but I believe the six-inch serves, more than any other, as a convenient medium.

For very general purposes, as geological maps, travelling maps, &c., they must be reduced to one inch, and combined. For such purposes as local registry, they form only the index; and the "parcels" must be exhibited by subsidiary enlargements. So also in valuations, they answer for country lots, which form the great mass; but the towns must be enlarged.

I speak most familiarly, of course, of that I have seen and known, viz., our uses of the six-inch scale in Ireland, but the same or very similar purposes must be everywhere required; and although there may be, and doubtless are, districts of England, as the manufacturing and mineral localities, where it is scarcely large enough, and tracts in Scotland, as the highlands, where it is need-

Memoranda
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Correspondence.

lessly large, I think these districts will usually be found so interspersed in the general country as to be scarcely worth making an exception for. In Ireland (parts of Mayo, for example,) we had many square miles of bog and waste not worth laying down on the six-inch scale, if they had to be done alone, but so mixed throughout the country that it would absolutely have been more expensive to have set men to survey and draw them on a smaller scale, than to sweep over them with the great machinery in common with the rest of the country.

I am for no Procrustean system, but for suiting the scale of the map to the object it is likely to be applied to; and while I think the one-inch general map ought to be extended over the whole Kingdom, I do not see any reason why England and Scotland, or any counties in them, need have the six-inch *because* Ireland has; yet, looking to the great number of *public-local* purposes to which social advancement now applies maps, and the great advantage and economy of executing the work by a sort of human machinery, *i.e.* by men who work like machines, without thinking or adapting, but move on uniformly, I believe the best plan, on the whole, is, to survey England and Scotland also on the six-inch scale, and reduce the whole to one-inch for a general map, leaving enlargements, which are usually for *private-local* objects, to be done at the cost of the parties, on the Government basis, and by the Government surveyors, if the parties choose to have it so, and to pay for it, and the men can be spared.

I have deferred writing on this subject for a few days, Mr. Griffith being out of town; but I will send him this to-morrow, and see him if I can; and if not, ask him to forward it, with the advantage of his remarks.

No. 5.

RICHARD GRIFFITH, Esq., LL.D., to SIR C. TREVELYAN.

Office of Public Works, Dublin, March 3, 1853.

I have read the inclosed, and I quite agree in Larcom's views regarding the six-inch scale. I gave evidence to the same effect when examined on the scale for the Scotch Survey before Mr. Charteris's Committee last year.

In making the tenement valuation, I find the six-inch scale sufficient for determining the area of tenements not less than one acre, measuring from the paper; where the area is less than one acre, its content is ascertained by measurement in the field.

The six-inch scale is sufficiently large to enable me not only to register the precise fields or lots of land operated on, under the Land Improvement Act, but to show accurately the length and position of every drain, together with the other works of improvement which may have been undertaken, as subsoiling, removal of surface stones, building of fences, &c.

No. 6.

LIEUTENANT-COLONEL DAWSON, R.E., to the HON. F. CHARTERIS.

Whitehall Gardens, April 4, 1853.

In obedience to your request, that I should state my opinion as to the value of the six-inch scale for those general purposes to which a national survey is applicable, and what scale I should be disposed to recommend for the survey and publication of the map of the cultivated districts of Scotland, and of the six northern counties of England, I have the honour—(by permission of the Master-General of the Ordnance)—to report, that in considering the value of the six-inch scale and the superior fitness of that scale, or any larger scale, for general national purposes, it appears to me important to trace the circumstances which first led to the adoption of the six-inch scale for the townland survey of Ireland, and subsequently to the adoption also of the same scale for the surveys now in progress in the North of England and Scotland; and in explanation of those circumstances, I would beg to refer to the evidence taken before the Ordnance Survey (Scotland) Committee.

Lord Monteagle there says; "The main practical object which we had in view, as Irish proprietors, was the consideration how far that survey could or could not be made applicable to our local taxation; that was the object of the (Irish Survey) Committee, and the recommendation of the Committee had that object mainly in view." His Lordship then proceeds: "I must explain, in a few words, our local territorial divisions, to show the necessity which we had of transferring those local divisions to the survey, and the scale at which that necessity compelled us to recommend that the maps should be made. Subordinate to the parishes, we have an internal division of smaller denominations, which we call townlands, which are very frequently, but not uniformly, conterminous with property. The principal estates consist of an aggregation of townlands, and therefore the townland division is a division which is generally conterminous with property. The townland was the lowest unit of taxation for country purposes; therefore it was absolutely necessary that we should obtain upon the map not only the boundaries, but the areas contained in those townlands, with a view to the application of a subsequent process of valuation to the area so obtained. If you take an average size of 200 or 300 acres for the townland, you must still require a survey on a very large scale in order to represent such divisions, it being absolutely necessary for our valuation, and the adjustment of our burthens, to have that representation of the townlands, both upon the map topographically, and subsequently in its area in the index. We were driven, of necessity, to a large scale. The resolution that was moved in the House of Commons was in March 1824, 'That it is expedient, for the purpose of apportioning more equally the local burthens collected in Ireland, to provide for a general survey and valuation.' That proposition is worked out by the Committee to mean a six-inch scale, without which the map would not have been useful for the purposes intended."

Mr. Griffith, before the Ordnance Survey (Scotland) Committee, says: "Originally, the map was to be simply a topographical map, containing the boundaries of the townlands, the roads, the streams, and the houses; with a view to the valuation of Ireland for the county assessment. The six-inch was considered to be the smallest scale that could be available for that purpose." "There was no intention originally to insert the fields."

It is thus shown that the six-inch survey in Ireland was specially limited to the one particular purpose of townland valuation, exclusive of fields, and requiring, as Lord Monteagle explains, that not only the boundaries, but the areas contained in those townlands, should be obtained.

It was well known to General Colby that the scale of six inches to a mile is too small to admit of the areas being obtained by admeasurement from the plans, with the degree of accuracy which is indispensable for civil purposes; and therefore it was specially provided for and required in his regulations and instructions to his officers, that the areas of the townlands should be obtained by calculation from the lengths of the lines actually measured upon the ground. Admeasurement of areas from the plans was only resorted to and permitted afterwards as a rough general check, to guard against the possibility of any gross error, through the accidental omission or repetition of an entire triangle: that was in 1825. "Subsequently," Mr. Griffith says, "representations were made by me, as the Commissioner for the General Valuation, that the detail was not sufficient; and that I required the principal farms and fields to be laid down, which has been done in all except a few of the northern counties of Ireland. The boundaries of farms and fields have been laid down."

Captain Yolland also, before the same Committee, says: "But when the valuation begun, it was found by the valuers that additional minuteness was necessary to enable them to subdivide the townlands into the qualities of lands of which they consisted; and more especially that the boundary between the cultivated and uncultivated portions ought to be inserted on the maps with great accuracy. This rendered necessary a very extensive revision, which was undertaken in 1830." And Colonel Hall, before the same Committee, says: "It was making a survey by fields instead of townlands; putting in the whole of the details."

This was clearly, therefore, a wide and most important departure from the original intention of the six-inch survey in Ireland, which contemplated only, and provided for obtaining, the boundary and the area of the townland as the lowest unit of taxation; and, had it then been contemplated that the survey

and map would be required to represent fields, and that areas of a single acre should be measured from the paper, it is not to be doubted that General Colby, who would not trust to paper measurements for the areas of entire townlands, would have adopted, at the very outset, for his manuscript plans of these minute subdivisions, a scale much larger than that of six inches to a mile.

108 It must be borne in mind also that it had not then been determined to engrave the plans of the townland survey of Ireland; and, consequently, that no objection could then have suggested itself, from the apprehension of increased expenditure, on that account. Lord Monteagle says; "What we conceived would have been the result was, that the field work should have been done upon that scale; that we should have got a return of the list of the townlands, and of the area of those townlands given to us, upon which we could have based our cadastre and our valuation; and then that the engraved map should have been one inch to the mile; in fact, the engraving on the larger scale of six inches may be considered a mere economical accident."

1016 And Mr. Griffith further explains: "In regard to the origin of the six-inch scale being engraved, I should mention that, as Commissioner of Valuation, I required six copies of the six-inch map, for the purposes of field-work, for a calculation in the house, and for preparing fair plans for preservation. It was ascertained by Colonel Colby that the expense of making six copies would be fully equal to laying down on copper; and, consequently, with the concurrence of the Government, the whole was laid down on copper."

In 1837-8, the Highland and Agricultural Society of Scotland pressed for a survey of Scotland on the scale of six inches to a mile, "simply," as their Secretary (Mr. Maxwell) says, "from its adoption in Ireland." "They had no means of judging from experience of the effects of the six-inch map then; but, knowing that it had been given to Ireland as a boon, they conceived naturally that it was to be equally good for Scotland." Their memorial refers to the additional means of improving the inland communications of the country that will be afforded by maps constructed with accuracy on an enlarged scale; to the fact that whilst France, Austria, Bavaria, &c., have maps on large and magnificent scales, there is a large portion of Great Britain of which no maps exist that can be relied on; the memorialists "feel assured that every information which may be afforded by the maps will be perfectly accurate; that the maps will be more or less valuable in proportion as they convey more or less information; and, in order to increase the kind and quantity of information, it will be necessary to enlarge, in a corresponding degree, the scale on which the maps shall be constructed; that the scales for England and Ireland were probably fixed with reference to certain particular objects which they were intended to subserve; and (after specifying the objects to which the Scotch maps may be made subservient) "they leave it to others more competent than themselves to determine the scale on which the Scotch maps should be constructed, knowing well that those who will be consulted as to the plan and details of this truly national work will be persons who, on account of their experience, talents, and zeal for the public service, are in every way qualified to advise what will be most useful to the country." Memorials were also presented from the Literary and Philosophical Society of Manchester and other public bodies, setting forth the advantages to be derived from the publication of maps of the six northern counties of England on the six-inch scale, in facilitating the execution of numerous undertakings; and General Colby was thereby eventually induced to submit a recommendation on the subject," expressed word for word with that contained in the memorial of the Highland and Agricultural Society, dated 22d March 1839." The expression is, "With regard to the scale of the maps, your memorialists are inclined to suggest that there should be a general map for the whole of Scotland (uniform with the map of England), on a scale of one inch to a mile; and that there ought to be a special survey of the manufacturing and mining districts, and those parts of the country which are highly cultivated or improvable, on a scale of six inches to the mile, similar to the Irish Survey."

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It appears to me that General Colby acted unadvisedly in yielding to the pressure of the Highland Society and the numerous other memorialists in favour of the six-inch scale for England and Scotland, and it is evident that the memorialists did not rightly understand the capabilities and scope of the scale they were asking for, the six-inch scale not being practically applicable to many civil purposes for which maps on a larger scale than one inch to a mile are here

required. The Highland Society have, in fact, since changed their opinion on the subject; and Mr. Maxwell assigns as a reason for it, among many others, that "that which induced them to ask for the scale has since induced them to change their opinion,—the example of Ireland,—because they conceive that the experience of Ireland has proved the six-inch scale map to be a great mistake; that it has been found there to be comparatively useless for most local and practical purposes."

With reference to the adoption of the six-inch scale for Scotland, Lord Mont-eagle observes: "You must consider the local divisions, or the smallness of the local divisions, analogous to Irish townlands that you would wish to represent;"—in other words, the lowest unit of taxation; "for though you might want the survey for taxation, if you have not a local division in Scotland corresponding to our townland division, the six-inch scale would not be required:"—in other words, if, from the smallness of the local divisions, the lowest unit of taxation is less than the average area of a townland in Ireland (200 or 300 acres), the scale of six inches to a mile would not be applicable to it, or large enough for it. And his Lordship adds: "You would, I think, act very unwisely if you adopted that which is good for one purpose, instead of that which is practically useful for many purposes."

The civil purposes for which plans on a large scale are required in this country are numerous. It is not a single purpose of townland valuation which has to be provided for, as was, in 1824, the case in Ireland. On the completion of the Irish survey, when the six-inch survey was first commenced in England, the Tithe Commutation Act and the Parochial Assessments Act were in full operation; and, for the purposes of those Acts, plans drawn to the scale of six inches to a mile are wholly inadequate. This was represented by me at the time to General Colby, as an objection to the adoption of the six-inch scale in England; and the Tithe Commissioners and the Poor Law Commissioners joined in the remonstrance, urging forcibly that if, for national purposes, it was desirable to prepare maps on a larger scale than the general Ordnance scale of one inch to a mile, such a larger scale should be adopted as should be sufficient for all civil purposes. The remonstrance, however, was disregarded, and the consequence has been that, except for the moorland district of the township of Dent in the West Riding of Yorkshire, and for a few large parcels of land in two or three other townships, I am not aware of a single parish or township in which the Ordnance six-inch maps have been used for the purposes of the Acts which I have named, or of the Inclosure Act, which has since come into operation. It should be stated, also, that during the time that the Ordnance surveyors were engaged with the preparation of their six-inch map of Lancashire and Yorkshire, they were called upon and employed to make, at the expense of the landowners, twenty-three plans of parishes and townships, on the scale of twenty-six and two-thirds inches to a mile, for tithe commutation; that the General Board of Health, which has more recently caused a demand for property-plans for sanitary purposes, has declared the Ordnance scales of six inches to a mile for rural districts, and sixty inches, or five feet, to a mile for towns, to be insufficient for their purposes, and has adopted, in lieu of them, the scales of twenty-four inches for rural districts, and one hundred and twenty inches, or ten feet, for towns; and that the Ordnance Survey Department have been extensively employed in preparing plans on those scales for sanitary purposes; that the plan of London, recently made for the Metropolitan Commissioners of Sewers, on the scale of sixty inches, or five feet, to a mile, is, in like manner, found inapplicable to house-drainage within the town-area; and that the Commissioners have, in consequence, found it necessary to construct plans on the larger scale of one hundred and twenty inches, or ten feet, to a mile, for that purpose; that at the present moment I have under my examination, for parochial assessment, a plan of the township of Worsley, in Yorkshire, containing 6,983 acres, on the scale of twenty-six and two-thirds inches to a mile, with which the Ordnance six-inch map is sent, merely as a diagram, to show how the main lines of the survey have been disposed; and I respectfully submit that the landowners and ratepayers in those cases would not have incurred the heavy additional expense of the new surveys, if the Ordnance six-inch and five-foot plans could, by possibility, have been made available for their respective services.

The reason for the adoption of the five-foot scale by the Ordnance Survey Department for towns was, that it was found convenient and economical to use a

scale exactly ten times larger than the other. It was doubtless, also, believed to be sufficient for the purpose required of it; and, as requirements for sanitary purposes were then scarcely thought of, its being the smallest that could be made available for the immediate object may likewise have operated with General Colby as an inducement for its adoption.

To the purposes hercin-before named, of
 Tithe Commutation,
 Parochial Assessment, and
 Inclosure;
 may be added,
 The General Board of Health (Sanitary purposes),
 Registration of Titles,
 Assurances of Land,
 Drainage,
 Sale and Transfer of Property,
 Management of Estates,
 Railway Plans, for Parliament, and Works,
 The Ecclesiastical Commission (Subdivision of Parishes), and
 Mineral Surveys.

These constitute, probably, only a portion of the many civil purposes for which plans on a large scale will be required in England, and to none of these could the six-inch scale be beneficially applied in the fullest sense, because it is not large enough to be used for the determination of the areas of the separate parcels of land or tenements with which, as units of taxation, it is requisite to deal; nor is it large enough to admit of marking, within the proper limits of the separate tenements, the reference-numbers to the accompanying terrier, in which the requisite particulars as to ownership, occupation, cultivation, acreage, &c., are recorded.

The circumstances, in respect of valuation in Ireland, were, and probably still are, essentially different from those which prevail in this country. In Ireland, at the outset, a gross valuation was put upon each townland, being the aggregate of the separate valuations of the several qualities of land in the townland. It was the quantities or areas of those qualities that were given, and not the areas of the fields, unless the fences of the fields chanced to coincide with the quality-lines,—a circumstance probably of very rare occurrence. The gross townland valuation was then subdivided among the several properties, according to their respective portions of the several qualities of land, and the quantities of the properties were equated to make up the total area of the townland. Each landowner then knew the gross valuation put upon his property, and he might possibly ascertain also the separate quantities of the several qualities of his land; but he did not know the quantity of land and the separate valuation of each field or tenement, and there was no visible trace of the quality-lines upon the ground, nor were the fences shown on the plan, to enable him to test or judge of the accuracy of the returns, and to ascertain whether the quantities in detail were right or wrong. Such was the course of procedure in Ireland at the commencement of the valuation. There has recently been substituted for it, I believe, or built upon it, a tenement valuation; but with what amount of satisfaction to those who are personally or professionally interested in it, I am unable to say. This I do know, that the map was not originally intended for it, and it is no fault of the six-inch map if it does not fully satisfy purposes for which it was not made or intended.

For rating purposes in England and for valuation, which enters more or less into consideration with one and all of the purposes I have enumerated, every separate parcel of land or tenement, however small, is required to be accurately drawn upon the plan, and to have marked within its limits a reference number to an accompanying terrier, as before stated; those numbers consisting very commonly of three or four figures, and possibly of five or six. It is, moreover, indispensably requisite that the exact acreage, as for buying and selling, should be obtained by admeasurement within the limits of each parcel or tenement upon the plan; and no surveyor, valuer, land agent, or other person employed in the management and transfer of land in England, would admit the sufficiency of a smaller scale than twenty inches to a mile, for ascertaining the areas with the

degree of minuteness and precision that is required ; though all acknowledge and accept as sufficient for the purpose the scale of twenty-six and two-thirds inches to a mile.

It appears to me that, for all national surveys to be made at the national expense, the primary and chief object should be to secure the possession of good manuscript plans, on a scale sufficient at least for every known purpose, as permanent public records ; and second to it, though scarcely of minor importance, is the publication of those plans on the same, or on some more convenient reduced scale ; and I therefore most strongly recommend for the survey and working plans of the cultivated districts of Scotland and of the six northern counties of England, the intermediate scale of twenty-four inches or two feet to a mile, for the rural districts, and the larger scale of one hundred and twenty inches, or ten feet, to a mile, for the towns ; which scales are generally admitted to be sufficient for the purposes I have enumerated, and, being multiples of one another and of the six-inch and one-inch scales, they offer other practical advantages. They are, moreover, the scales actually adopted by the General Board of Health, and very generally throughout the country, for sanitary purposes.

I do not consider it necessary, and should not recommend the plans to be engraved upon these scales, but that they should be reduced and engraved at twelve inches to the mile for rural districts, and five feet to the mile (as at present) for towns ; and it is my confident belief that engraved plans on these scales would be found practically available for all ordinary purposes, recourse being had to the working plans for the areas, and for traces when required on a larger scale.

These plans would be found to answer also for estate surveys, and probably there is no general purpose to which national plans can be more legitimately applied. If made to answer that purpose, they would answer every other purpose, and bring their benefits home to every man's door.

A scale approaching very nearly to the twelve-inch, namely, that of six chains to an inch, or thirteen and one third inches to a mile, has for a long series of years been very extensively in use throughout England and Wales ; it is almost invariably used for the plans attached to the deposited awards under the General Inclosure Acts ; probably a third part of all the plans in the Tithe Commission Office, or say about 4,000, are drawn to this scale ; a great number of the larger estates also, and the Metropolitan Commission of Sewers, have plans on this scale ; all being reduced for the purpose from the surveyor's working plans. It is, in fact, a scale well known and generally appreciated for ordinary reference and use.

I do not, of course, mean to say that no benefit whatever would result from the six-inch map. Where no plans on a larger scale were found, the public would of necessity use it, or seek to make it available. It would doubtless also be used to a certain extent for preliminary surveys for railways, and other engineering works ; but this might possibly be only partially benefitting a particular interest at a great cost to the public at large. And what I would most strongly and respectfully urge upon the Government is, that the question should not now be decided upon any partial or restricted view. It appears to me, that where many known purposes are to be provided for, it is not a medium scale that should be adopted, and certainly not a minimum scale, as in Ireland, where the smallest scale that could be available for townland valuation was selected, the lowest unit of taxation being 200 or 300 acres. In my opinion, such a moderate maximum scale should, in preference, be adopted, as should be equal to, and not greatly exceed the requirements of any known purpose ; that is to say, a moderate maximum scale for the working plans and as an official record, and the twelve-inch scale as a medium, instead of the six-inch, for ordinary use ; and that both for England and Scotland, where the six-inch survey is yet comparatively in its infancy, it is most undesirable that, by continuing the use of an insufficient scale, the public should eventually find themselves placed in the false position of being compelled to resort to expedients to obtain even a partial benefit from their maps ; or to incur for every fresh purpose the cost of an entirely new survey.

It has been strongly pressed upon my consideration, that the scale of twenty-four inches to a mile should not be insisted on for Scotland, and that it would be unnecessary and undesirable to incur the expense of laying down the work upon that scale, as the twelve-inch scale would there be found practically available and sufficient for every purpose. I am not at present informed of any

circumstances which should induce me to recommend the dispensing with a scale for Scotland which, for the reasons hereinbefore explained, I conscientiously believe to be indispensable in England. For the engraved plans, and having plans on a larger scale in the office, I admit the sufficiency of the twelve-inch scale for general use; and, while admitting also the superior execution in many respects of the Ordnance plans, and that, by the combined process of paper measurements and calculations with the chained lengths, a degree of accuracy might possibly be obtained which should apparently satisfy the public for all ordinary purposes, it would even then be necessary that the survey should be made with the minute accuracy requisite for laying it down to a larger scale, otherwise the areas obtained by calculation from the field measurements would not be sufficiently accurate; and the public would have no proper means of testing the accuracy of the areas. I know that the public feeling is very decidedly in favour of the larger scale; and I do not believe that that feeling would be readily, if ever, overcome.

It would be indispensably requisite also, in that case, to provide for making supplemental plans on the larger scale of all house properties in towns, villages, hamlets, and even of small groups of houses, throughout the country. The expense of these supplemental surveys would be very considerable, and the plans are always inconvenient for reference. I must therefore adhere to my opinion, that the scales which I have recommended are those which, under all circumstances, should be considered the best for the public interest.*

It appears to me that the question as to the relative merits of scales was very undesirably narrowed before the Ordnance Survey (Scotland) Committee, when confined to the one-inch scale and the six-inch; and that the Ordnance Survey officers had thereby no opening afforded for the expression of the opinion which they might entertain in favour of any larger scale. The scale adopted by General Colby has, as a matter of course, been continued by his successor, Lieutenant-Colonel Hall, whose executive officer (Captain Yolland) has given very decided evidence on the subject before the Registration and Conveyancing Commission, as follows: "The scale of twelve-inches to a mile would undoubtedly have been much better than the six."

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1661

"If the matter were to begin again, I should recommend the twelve-inch scale as a general scale."

1701

"The scale of twelve inches to a mile would admit of the insertion of reference numbers in the ordinary run of cases."

1705

"Supposing I were to begin now, twelve inches is the scale I would take."

1742

"I cannot too strongly express my opinion that an enormous saving to the community at large would eventually be introduced, were the Government at the present time to decide on executing a perfect national survey of the whole of Great Britain. Such survey should be made sufficient for all purposes, so that it may not be necessary to institute hereafter new surveys for every new public requirement that may arise. If, on the one hand, a survey on the present scale of six inches for the general map, and sixty inches for the towns of the northern counties and Scotland would be insufficient, it would be better that it should, before more public money is expended on it, be changed for a sufficient scale."

1903

"Upon the whole, I think that the twelve-inch scale is preferable, if the difference in the expense is not an objection."

1905

"I should certainly recommend that the whole of England and Wales be done on the same uniform scale of twelve inches to a mile, if that be the scale decided on as sufficient."

2221

"The public map would not do any good, unless it were a map of properties."

The immense importance of this subject will doubtless obtain for it the fullest and most deliberate consideration of Her Majesty's Government, and may possibly justify my offering a suggestion that, pending the consideration of the question at least, if not for a continuance afterwards, the Ordnance Survey Department should be authorized to proceed with the degree of minuteness

* Since writing the above I have ascertained, from a good practical authority, that "estate surveys are generally made in Scotland to scales of either three or four imperial chains to one inch; if the estate consists of arable land, the former scale is generally adopted; but if there is a considerable proportion of pasture land, or hill country, the latter scale is more frequently used." The information herein conveyed has been confirmed by two other practical surveyors in Scotland.—R. K. D.

which should admit of the work being laid down on paper to the larger scale of twenty-four inches to a mile; so that whether that scale should eventually be determined on or not as a permanent arrangement, the landowners and others interested in any particular parish or district might be enabled, at any time, to obtain plans on the twenty-four-inch scale, on payment only of the additional expense of drawing the work upon paper. The additional cost of carrying out this suggestion should not be very considerable; and as the Ordnance would, doubtless, be entrusted with the execution of the surveys, I venture also respectfully to suggest that the Superintendent of the Ordnance Survey should be requested to furnish the requisite estimates.

The average rate of charge for surveying work in England and Wales on the twenty-four-inch scale by the civil profession, and exclusive of towns, may fairly be stated at *9d.* per acre; this provides for the production of a fair draft-plan and a reference-book showing the separate area of every tenement. The Ordnance rate would include also, in addition, a charge for the trigonometrical survey, or instrumental triangulation; a charge for reduction from the twenty-four-inch to the twelve-inch scale; a charge for engraving also, and for official superintendence;—and the Ordnance Survey officers should be best able to estimate what these several charges should amount to. The Ordnance Survey officers should also be best able to estimate the probable expense of preparing a compiled map of England and Wales on the twelve-inch scale, on the basis of an instrumental and measured triangulation, using for the purpose, to the fullest possible extent, the existing public plans now in the custody of or made for the Tithe Commissioners, the Poor law Commissioners, the Inclosure Commissioners, and others; and making new surveys where proper plans cannot otherwise be obtained.

With reference to Major Larcom's and Mr. Griffith's letters to Sir Charles Trevelyan, on which you call for my remarks, I have but little further to observe. I should be very sorry to appear to be at issue with them, as I attach a high value to their judgment in such matters; and I do not believe that there is, really and truly, any difference of opinion between us on this question, when it is fully stated. But should it chance, under any circumstances, to involve a balance of opinions, I feel assured that they would both desire that mine should have equal weight with their own.

Major Larcom says: "The six-inch scale has fulfilled all the purposes to which it has been applied in Ireland."

I freely and fully admit that it has most completely and satisfactorily fulfilled the object for which it was primarily intended; namely, the valuation of Ireland by townlands; and, General Colby having completed a six-inch map of all Ireland, it was undoubtedly Major Larcom's duty to use that map wherever it was practicable to do so, and to avail himself of every possible expedient to make it available and useful, to the fullest possible extent, without putting the public to any additional expense for new surveys; but whether, for England also, at the very commencement of the survey, and for numerous other objects, all requiring fuller detail and much greater accuracy than the six-inch scale admits of, Major Larcom would advise the adoption of the six-inch scale in preference to a larger one, is a very different question.

"I know it is said, by those who oppose its adoption in England and Scotland, that it is not large enough for an estate map, and too large for a general map; and this to some extent is true, but it is not meant for either."

This carries its own explanation, so far as the survey of Ireland is concerned. I apprehend that it is meant, in England and Scotland, that the plans which are now to be made, at a cost equal to the ordinary cost of estate maps, should be so made as to serve all the purposes of estate maps, and the many other great and important purposes for which Lord Langdale, in his letter of the 30th of November 1848, states that good and accurate public maps are required; his Lordship adding, that in almost every case in which maps are wanting for a purpose not before contemplated, it is found that maps previously constructed at great expense are inapplicable, or not well adapted to the new purpose.

"I think the objectors to this scale are generally persons who use or require the maps but for one purpose, for which some find them too large, some too small; and, on the other hand, its advocates claim too much for it by supposing, what is impossible, that it renders all other scales unnecessary. The truth is, no one scale can subserve all purposes; but I believe the six-inch serves, more than any other, as a convenient medium."

The objections of those who seek to use the map only as a general map will have been removed by the Treasury Order of the 21st of October 1851, for the preparation of the one-inch map. The objections of those who find the six-inch scale too small, do not, in England, apply to one purpose only. I have previously enumerated twelve distinct purposes for which plans on an enlarged scale are now known to be required, for one and all of which the six-inch scale is decidedly inadequate. Major Larcom admits that "there may be, and doubtless are, districts in England, where the six-inch scale is scarcely large enough;" and it would certainly appear to me that, at the commencement of a national survey which is intended to subserve many great and important purposes, we ought not to select a "medium" scale, which is confessedly too small for some of the purposes which it is intended to subserve; but rather, such a moderate maximum scale as should be equal to, and not greatly exceed, the requirements of any.

"For such purposes as local registry, they form only the index; and the 'parcels' must be exhibited by subsidiary enlargements. So also in valuations, they answer for country lots, which form the great mass."

It is not the "lots" with which we have to deal in England, but with the "parcels," or tenements; and Major Larcom admits that, with the six-inch scale, the "parcels must be exhibited by subsidiary enlargements." So also Mr. Griffith says, "Where the area is less than one acre its content is ascertained 'by measurement in the field.'" I need scarcely explain how impracticable it would be in this country on every occasion to resort, in every such case, to measurements in the field, or to apply any test to the accuracy of the areas so obtained; and how almost equally impracticable it must be to attempt to exhibit all parcels of land in this country by subsidiary enlargements.

"I speak most familiarly, of course, of that I have seen and known; namely, 'our uses of the six-inch scale in Ireland.'" And immediately afterwards "There may be, and doubtless are, districts in England where it is scarcely 'large enough.'"

As before stated, I repeat that, if Major Larcom were fully informed of the purposes to which it is desired to apply these enlarged plans in England, and the degree of accuracy which is essentially requisite for setting out and obtaining the areas of minute parcels of land from the paper, he would cordially agree with me in recommending the adoption of a scale larger than that of six inches to a mile.*

1044 Mr. Griffith refers to the evidence which he gave before the Ordnance Survey (Scotland) Committee. His opinion as to the scale for public maps is there recorded as follows: "My feeling is, that no map made by the public should be undertaken upon a scale on which all the subjects to be represented cannot be accurately laid down in their places so as to bear measurement in every direction."

160 Lord Monteagle further says: "For the purpose of individual property you must have recourse, in most instances, to a more broad survey than even the six-inch scale."

193 Mr. Brunel says: "The surveys that we want eventually are surveys upon
197 "a large scale, which lay down the actual individual properties of individuals,
"for the purpose of taking accurate measurements upon them." "As soon as the
209 "works have been commenced, the ground has to be surveyed accurately; there
"is no information on the six-inch scale which would save that." "The six-inch
"map would not be nearly large enough for setting out the works."

* Having communicated the foregoing remarks to Major Larcom, with a suggestion for his consideration, whether they might induce him to omit or modify, in the last paragraph but one of his letter, his recommendation of the six-inch scale for England and Scotland, his reply to me is in these words: "I am sure you are more conversant than I can be with the requirements of a survey in England, I can therefore have no objection whatever to the omission of the paragraph you have marked in my letter, if it is thought calculated to convey more than Irish experience is worth as a guide in England."—R. K. D.

Mr. Maxwell says: "The six-inch map we look upon in this light, that it is neither a map nor a plan; it is not a map, and yet it is not large enough to be used as a plan of your property." (336.)

Mr. Keith Johnston says: "With the six-inch map, for all practical purposes, we shall be no better than we are now." "I certainly think that the six-inch plans would not serve local engineering purposes, and save the expense of plans for drainage, the construction of railroads, and other public works." "I have had some experience in producing plans for disputed questions, and in every court of law in which I have seen them produced, it has been necessary to make them upon a very much larger scale than six inches to a mile." "I think the scale adopted by the Ordnance Department for the large towns and cities is quite small enough, perhaps too small, for sanitary purposes." "I am now prepared to say that the five-foot scale is considered, in Edinburgh, too small for sanitary purposes."

Sir John Macneill says: "If you want an accurate plan, I think you must have it at least six-inches. My own impression is, that six inches is too small. I wish it had been larger in Ireland."

Mr. Stephenson, says: "I hardly think any landowner would be content to have a plan of his estate on a scale of six inches to a mile; he would rather have it drawn at two chains to an inch, which would be forty inches to a mile." "For sanitary purposes it must be on a much larger scale than five feet to a mile." "For the primary laying down of those sewers, the five feet map is sufficiently large." "For mining operations, the six-inch scale would be still worse, because the usual scale for mining operations is half-an-inch to a chain, or forty inches to a mile."

Mr. Locke says: "I do not think the six-inch scale is sufficiently large as a plan of a proprietor's estate." "I made those tunnels under the town of Liverpool. I consider tunneling on railways to be much the same thing as drains for the purpose of drainage. I am sure I could not have accomplished all the objects I had in view if I had not had a map on a larger scale than five feet."

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With reference to your request that I should report to you any general remarks which occur to me on the subject, I would beg to point your attention to the means proposed for the preparation of the general map on the one-inch scale.

The standard of excellence aimed at by the Ordnance Survey (Scotland) Committee, was the Ordnance Map of Wales.

Lord Monteagle says: "I should rather take as my model the English survey. When I say the English survey, I mean the better parts of it, because the sheets vary very much, and there is nothing in which the progress of improvement is more visible than in the English map; but taking the English map, we will say some of those beautiful sheets in South Wales, which are exquisite, as well as some of the later sheets which they have published, I do not think you can go in map-making beyond that."

His Lordship also says: "A map which is really well engraved, as the modern maps of the survey of England really are, *chefs d'œuvre* of engraving as well as of drawing, exquisitely drawn and engraved."

Sir Roderick Murchison says: "I beg to express my most decided conviction that they produce nothing on the Continent equal to our best maps, as recently published in this country by our own Ordnance survey, of which I lay what I consider a beautiful example before the Committee, of a part of Wales:" "which I think so perfect a delineation of the country that nothing more can be called for." "If I add to that map of Wales, the height of every principal mountain, hill, and valley, then I have everything that, as a geographer or geologist, I can desire for such a country as Scotland; and such is the map of Scotland which I most ardently desire to see published."

Mr. Keith Johnston says: "I should, above all things, wish to see this proposed map of Scotland made a model; in fact, something such as has never been done before. I think that the great variety of physical features in the country would enable it to be done in a style to make the picturesque effect of

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the map such as never has been done in any other country, if properly gone about." "I consider the opportunity for making a splendid map of Scotland to be so very peculiar, such as has not occurred before, and is not likely to occur again for a very long time; I should desire, above all things, to see proper means taken to have it done in the best manner."

The map proposed by the Ordnance Survey Department is thus described:—

1497 Captain Yolland says: "The last quarter sheet was published about a year
1498 or a year and a half ago; but that was prepared from the reduced contour lines, and not drawn on the ground at all."

1499 Being asked, "By what method do you intend to publish the one-inch map
1504 for the northern counties of England?" he says, "Precisely in the same manner as the last quarter sheet, not sketched on the ground; but the hill-shading is shaded from the information afforded by the contours, and given to the engraver to etch the vertical hachures. That is the way that the drawings which are to be put into the hands of the engraver will be prepared. This is a sample of what the public will have."

1563 "How is the effect in the south-west quarter of sheet 91 of Lancashire
1564 produced?"—"It is shown by vertical hachures. Those were engraved by a reduction of the contour lines to that scale being given to a competent engraver, not even taking the trouble to make the hill-drawing for the purpose of engraving those hachures themselves."

Being asked, "What do you consider to be the best mode of publishing the general map; I mean, of delineating the physical features of the country?"
1532 Captain Yolland says, "By contours, without the slightest doubt;" "without
1533 any shading whatever." "There is not the slightest doubt upon the subject; it
1553 does not admit of a question at all that the contours are perfectly accurate;
1571 whilst this, on the contrary (shading by vertical hachures), gives no information beyond the pictorial effect." "We are perfectly convinced of the superiority and advantage of the contours reduced, without any additional shading by vertical hachures."

1575 "You are going to publish a general map for the whole of the northern counties of England, without sending any person on the ground to sketch the hills?"—"Yes."

"By the hachure shading from the reduced contours?"—"Yes."

"As exhibited on this sheet?"—"Yes; of Fleetwood."

"That is a specimen of the one-inch general map that will be published for the whole of the northern counties of England?"—"Quite so."

908 And Colonel Hall says: "I think they would have a better map if it were
909 delineated by the reduced contours, instead of by hill-shading. It may be proper to make the northern counties uniform with the southern; but for no other reason could I do otherwise than prefer the reduced contours."

As a practical surveyor myself, and having had greater practical experience in hill-sketching and drawing than any man in the kingdom, with the single exception of Mr. Dawson, of the corps of Royal Military Surveyors and Draughtsmen, late Principal Surveying Draughtsman on the Ordnance Survey, I consider it to be my duty to the Government and to the public to state my unqualified opinion, that it would be impossible, by the means here proposed, to accomplish satisfactorily the object aimed at in the evidence of Lord Monteagle, Sir Roderick Murchison, and Mr. Keith Johnston. I wish distinctly to be understood as not saying this offensively. I would state, as a reason for it, that the Welsh map is a work of very high art, which it must be impossible to produce by any purely mechanical process; and it might in fact be equally expected that a portrait painter should produce a characteristic drawing of a person whom he had never seen, by means of mathematical contours; or that an engraver should equally bring out the likeness, by means of hachures at right angles with the contours, "not even taking the trouble to make a drawing for the purpose."

I would beg to refer to the printed evidence in support of this opinion.

147 Lord Monteagle says: "I cannot imagine any benefit in contouring, if it were practicable, in the Cumberland country, that I am familiar with; but sure I am that there are no lines of contours which you could put on which would

represent the side of Stride-ridge, and the other passes up to Helvellyn; it would be impossible to represent the country in that way: you may represent it after the old fashion, but you could not represent it, I think, in contouring; your lines would come so very close to each other, that, after all, it would only result in contouring—to something like what you have abandoned.”

To the question, “I understand your Lordship’s opinion to be, that you would prefer the hill-sketching to the contouring?”—His Lordship’s answer is, “Certainly.”

Sir Roderick Murchison says: “Contour lines do not convey to my mind an adequate notion of the physical relief of the country.” “The contour lines are specially applicable to soft, undulating countries, where the sides of the hills are not broken in upon by abrupt precipices, deep semicircular ‘corries,’ and other features, which are so very prevalent in Scotland, and particularly in the Highlands. Single bosses of rock which there jut out, as it were, on the central part of a promontory, and rise in pyramidal and other forms, are exceedingly difficultly expressed. I do not know how they can be expressed by contour lines, or without the addition to the contour lines of some shading.” “I repeat, that by contouring alone, you cannot represent the proper physical relief of a country.”

Mr. Brunel says: “To me they do not convey any impression of the features of the country, except in the very hilly part.”

On being asked, “Would it be practicable in a decidedly rugged country to contour with any degree of accuracy?”—The answer is, “Of course, everything is practicable; but it is about as improbable that that should be done, as you can very well imagine anything.”

And to the further question, “Would there be any use in doing it in such a country?”—Mr. Brunel’s answer is, “You cannot otherwise represent it at all by this system.”

“Would it be of any practical use?”—“No, I do not think that it would; but that is the difficulty of this system. How are we to know in looking at a map, where the contour lines are to be relied upon, and where they are not? You cannot leave them out, because that makes a white place in the paper, which then deceives you; it is represented as flat; it is something which conveys wrong information, as well as not giving any. In sketching a hill on a moderately small scale, you may give more or less detail, but it does not mislead; whereas in contour lines, if you actually make them go straight across a broken piece of ground, or omit them, you are positively misleading, not simply omitting information.”

Mr. Keith Johnston, being asked, “Do you believe that by the reduction of contours from the six-inch to the one-inch scale, the physical relief, which ought to be given in a general map, can be correctly given without shading?”—His reply is, “No, certainly not; the physical features cannot be given without shading in any circumstances.”

“Would it entail sending people on to the ground to sketch the form of the hills on the spot?”—“Yes, I think in all cases; at least with reference to Scotland, no system of contouring would prevent the necessity of sketching on the spot.”

“Do you believe, from your knowledge of these different systems of delineating the physical features of a country in such a mountainous country as Scotland, that the necessary physical relief could be given by the simple contours without the addition of shading?”—“Certainly not; I am convinced it could not.”

Mr. Keith Johnston further offers as a suggestion: “I think that the importance of such a work is so great as to justify the Committee, if they think proper, in getting the opinions of men best able to judge, as was done in France.” And he adds: “I think, unless you adopted some such course, such questions as contouring and hill-shading would not be decided.”

Sir John Macneill, being asked, “Do you think that the system proposed to be adopted in the general map, on the scale of one-inch, namely, the system of reduced contours, gives you any such notion of the physical features of the country as is conveyed by the ordinary method of hill-sketching?”—His reply was, “It would to a professional man, but not generally to the public.”

Mr. Stephenson says: “I think the one-inch is most agreeable for the

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Highlands of Scotland; and it would make a very beautiful map if the system was carried out."

And further on, he says: "You could shade the hills in the office, but I think it could be done at a much less cost, and I think the true effect may be more certainly conveyed, by an artist going over the ground."

Mr. Locke says: "If the courses of the rivers are accurately shown, it is as likely that the hill-sketching should be accurate as that by contouring or any other operation upon the ground would be. I cannot see why it should be assumed that one operation is to be incorrect, and another precisely correct."

And being asked, "Are you of opinion that the best method of delineating the physical relief of a country is by hill-sketching?"—Mr. Locke's answer is, "Yes, I think so."

I would beg to refer also, to the printed evidence to show, that, independently of the contours, the Ordnance Survey Department does not, at present, possess the means of carrying out the object as it was accomplished in Wales, and with the degree of excellence which is desired.

Captain Yolland says: "I am the Executive Officer at the Head Quarters Office at Southampton." "Only one quarter-sheet of the one-inch map of a portion of Lancashire has been published." "If we were to do away with that mechanical operation we now use, we must bring in people who can think and act, and exercise discretion, and so on; therefore we must have a higher-paid and superior class of assistants to those that we now have. I do not think that we have half-a-dozen people, out of 1,500 employed, who could hill-sketch; while, on the contrary, there is no difficulty whatever in teaching a man to contour."

"You have said that, in one case, your men are like machines?"—"Yes, quite so." "There are no trained or instructed people qualified to carry out certain parts of the work; at least I believe so. I instanced more particularly the hill-sketching, which is a very important and costly part of the one-inch map; and I am sure that, although we could get over the mechanical parts, as regards the surveying and the detail, and the drawing of the plans, still we cannot get people who can do the other, so as to do it in one-third the time." "I do not mean to say that we have not actually got gentlemen who are surveyors capable of hill-sketching; we have a few. I should think if I said four, I should name the outside number: and the others, most of them, have sought better and more lucrative employment in the civil profession."

To the further question, "Then all the objections that you have been raising to the rapid progression of the survey, have been entirely owing to the want of persons sufficiently qualified to hill-sketch?"—The reply is, "I think that is the primary cause." And to the question, "Have you hill-sketchers now employed on the English map?"—Captain Yolland's answer is, "We have none employed on the English map."

To this evidence I would venture to state further in explanation that the department by which the Welsh map was produced, originated and was trained and employed under the immediate personal superintendence of Mr. Dawson, to whom the merit of that work, as a work of art, is justly and solely due. Mr. Dawson has since retired from the service, superannuated; and his trained assistants have, "most of them, sought better and more lucrative employment in the civil profession." So also with the Hill-Drawing Department which I myself trained in Ireland, the members of which have, all but one, sought better employment in the civil service.

With reference to the civil profession generally, Captain Yolland, on being asked, "If you were to have recourse to the civil profession, you might find plenty of persons adapted to that service?"—His reply was: "I do not think so; I do not believe that that is a branch of their profession that has ever been practically carried out to any extent whatever."

I entirely agree with Captain Yolland in this, and I can state more positively as a fact, that none but those specially educated by Mr. Dawson, or by those whom he taught, can be qualified to practise hill-sketching and drawing, as he practised it in Wales, because the style originated with him, and was peculiarly and exclusively his own: and it is not to be acquired by any mechanical process, nor can it be taught in a day. By way of exemplification, I may point to the recently published sheets of the neighbourhood of Sheffield, and a portion of Derbyshire, with which Mr. Dawson had nothing whatever to do, and with reference to the

objections taken to those sheets in the answers to questions 1534, 1536, I would beg to observe, that the pictorial effect or expression of a map is not simply dependent on the use of vertical or horizontal hachures, as a means of producing it, for in fact it may be produced equally with either; it is in reality due to the just and proper application of the principles of light and shade. For the field sketches, horizontal hachures or lines are used, and they would probably have been introduced into the engraving process also, but that the public generally are not accustomed to them, and would not probably understand them. Nor is the difficulty complained of "in deciphering the names along the sides of the valleys," a necessary consequence of using vertical hachures, but of working with "machines," instead of "people who can think and act, and exercise discretion," otherwise the result should have been the same in the map of the mountainous districts of Wales.) It is in fact attributable, and solely attributable, to the want of artistic apprehension and ability on the part of the draughtsman, or to the engraving being made, as it were, by a machine, without the intervention of a draughtsman at all.

It is essentially requisite, therefore, that the subject of the preparation of the one-inch general map of Scotland should obtain early and most serious attention: and I would venture to suggest that a sufficient number of proper persons should immediately be selected and put under competent training, and that all who are to be practically engaged in the work should,—by unremitting study from characteristic models of hill-forms, and by actual hill-sketching upon the ground, seek to acquire that degree of artistic skill and ability, both as to the right apprehension of the natural forms, and the representing and grouping those forms truly, gracefully, and pictorially on paper, by a judicious and proper application of the principles of light and shade, as exhibited in the Ordnance maps of North and South Wales. Unless this be immediately undertaken, and prosecuted with becoming energy and zeal, it must be impossible that the persons to be employed on this special service can acquire a proper amount of qualification in time to proceed with the work and complete it, as desired, within the period fixed by the Ordnance Survey (Scotland) Committee. To complete the whole of Scotland in ten years would require the constant employment of ten or twelve well qualified hill-sketchers, and four or six draughtsmen in the Office. There are now only four hill-sketchers on the English survey, and one in Ireland; but it is probable that two or three of those who have left the survey might be induced to accept employment again.

I would venture also to suggest, that a small corps of engravers should immediately be organized and trained for the hill-work, because, although the engraving of the Welsh map is undoubtedly well executed, it must still be admitted that it does not truly embody and bring out the great masses and the characteristic details of the ground, as they were apprehended by Mr. Dawson, and are, effectively and beautifully, portrayed in his drawings; and as they should be represented in the proposed general map of Scotland, if that map is to be creditable to the progress of science and of art at the present day.

In conclusion, I would venture to hope that I have not herein expressed my opinions unbecomingly, or in a way that should justly be considered offensive to any one. Should it, however, be thought that I have done so, by speaking too plainly or too strongly, I trust that a consideration of the nature and extent of the services from which those opinions are derived, may, in some measure, plead my excuse. Educated from my childhood in the various branches of surveying duties; actively employed for 17 years on the Ordnance Survey; and, subsequently, for 17 years in the preparation of plans for civil services; during which latter period upwards of 12,500 plans of parishes and townships in England and Wales have been made under my direction; selected on various occasions for employment on such services—by General Mudge for the trigonometrical survey; by General Colby for his professional investigations, and for the formation and superintendence of the hill-drawing department in Ireland; for the Parliamentary Boundary Commission under the Reform Bill, and for the Municipal Boundary Commission; by the Colonial Office under successive administrations during the last 12 years; by the Tithe Commission; the Poor Law Commission; the Inclosure Commission; and the Metropolitan Commission of Sewers,—I may, without vanity or affectation, assert that I have been more extensively and practically employed in surveying duties than any other person in the kingdom. My experience leads

me to entertain the opinions which I have endeavoured to express forcibly, though, as I would still hope, unobjectionably; and I trust that it will be borne in mind, also, that the expression of these opinions has been called for by the Treasury, and is offered by me in dutiful submission to the authority of Her Majesty's Government.

No. 7.

Sir C. TREVELYAN to C. VIGNOLES Esq.

March 10, 1853.

With reference to your letter to Sir John Burgoyne of the 6th July 1851, in favour of the six-inch scale for the Ordnance maps of the northern counties of England and Scotland, will you have the goodness to inform me whether you have considered the advantage which might be derived from a still larger scale; and whether, for all the purposes which a national survey should be expected to subserve, it would or would not, in your opinion, be desirable to adopt the scale of twelve inches to a mile instead of six?

Similar letter to J. W. Leather, Esq., Leeds.

W. M. Rankine, Esq., 30, Great George Street, Westminster.

Robert Vans Agnew, Esq., Barnbarroch.

J. F. Bateman, Esq., Manchester.

Philip Park, Esq., Preston.

C. Piazzzi Smyth, Esq., Hill Crescent, Edinburgh.

No. 8.

C. VIGNOLES Esq. to Sir C. TREVELYAN.

4, Trafalgar Square, March 21, 1853.

I had the honour of receiving your communication of the 10th instant, "referring to my letter of the 1st of July 1851, addressed to the Inspector-General of Fortifications in favour of the six-inch scale for the Ordnance map of Scotland; and inquiring whether I had considered the question of adopting a still larger scale for all the purposes which a national survey should be expected to subserve, and whether, in my opinion, it would or would not be desirable to adopt the scale of twelve inches to the mile instead of six.

I beg to premise that I do not consider it would be doing justice to this important question were I to limit myself to a categorical answer thereto.

As a simple choice between a scale of six inches or of twelve inches to the mile, I am of opinion that it would be desirable to adhere to the six-inch scale, supposing the surveys to be carried out as in Ireland, with additional maps of populous places on the enlarged scale of sixty inches to the mile.

But it is manifest that a much wider range for discussion and opinion is opened, when there has to be taken into account "all the purposes which a national survey should be expected to subserve;" and availing myself of this just and comprehensive expression, I will enter somewhat into the consideration of this question.

The following purposes may be assumed as coming properly within the category of "purposes of a national survey:"—

1. Geodesic and purely scientific.
2. Geological.
3. Military—general and special.
4. Naval—as the basis of charts of the coasts, harbours, and estuaries.
5. Parliamentary—in reference to Standing Orders.
6. Engineering—preliminary and in detail.
7. Poor Law arrangements.
8. Tithe commutations.
9. Parochial and local assessments.
10. Sanitary.
11. General drainage.
12. Disputed rights and boundaries.

13. Town improvements, local drainage, water supplies, and police regulations under legislative powers.
14. Mineral.
15. Future registration of assurances.
16. Future public assessments.
17. Future agricultural and statistical returns.
18. Generally interesting to the public.

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It is manifest that no one scale could be adopted equally applicable to all these varied and important purposes.

Arranging them in classes, it may be easily shown, from evidence already laid before Parliament, or put forth publicly, that only for the first and last of the objects in the preceding list would a scale less than one mile to the inch be appropriate; that for geological and general military purposes, and as the basis of naval charts (of the coast only), the scale of one mile to the inch would be sufficient; but that for all the other purposes of a national survey, maps on a much larger scale are absolutely necessary.

Of these other purposes the following have been generally considered as satisfied by having the survey laid down on a scale of six inches to the mile, viz.: Special military; Naval, as the basis of charts, in detail, of harbours and of estuaries (most especially necessary for Scotland); Parliamentary, in reference to Standing Orders; Preliminary inquiries in civil engineering; Mineral; Poor Law arrangements; and General drainage.

It is, however, the opinion of many competent persons, that all these last-mentioned objects would be best served by maps published on the larger scale of twelve inches to the mile, although in this opinion I do not concur.

But there still remain many highly important "purposes, which a national survey should be expected to subserve," which cannot be provided for except by maps on a scale sufficiently large to show the divisions of property in minute detail, with great clearness, and so as to be separately distinguishable by figures of reference, and so that the area of every small holding be accurately determinable.

I am of opinion that these latter objects cannot be effected by maps on the scale of six inches to the mile. The scale must be still further extended to accomplish in a satisfactory manner what is required. Nevertheless the six-inch scale ought not to be departed from unless the importance of the purposes for which these maps are necessary should justify the expense of their being laid down on the larger scale; which scale I consider ought to be at least twenty inches to the mile, or four statute chains to an inch: indeed, good reasons might be advanced in favour both of twenty-four inches and of three chains to an inch, which is nearly twenty-seven inches to the mile.

The purposes requiring maps so considerably larger than the six-inch scale may be generally defined as social, fiscal, and statistical; and admitting their importance, it may be well to inquire into the comparative cost of executing, and of subsequently multiplying, copies of original maps laid down on different scales.

It is shown by the evidence of the Ordnance officers, that the expenses of surveying, mapping, engraving, and publishing on a scale of one mile to the inch, is between 8*l.* and 9*l.* per square mile, or about 3¼*d.* per statute acre, of which 1¾*l.* per square mile, or ½*d.* per acre, is the cost of engraving and of copper plates; and that the corresponding cost on a scale of six inches to the mile (including surveying and engraving plans of towns on the scale of sixty inches to the mile), is about 21*l.* per square mile, or 7⅞*d.*, say 8*d.* per acre, of which 2⅔*l.* per square mile, or 1*d.* per acre, is the cost of engraving and of copper plates.

In this comparison, the expense of levels and contours is excluded. The separate cost of these is 4*l.* per square mile, or 1½*d.* per acre.

Thus the actual cost of surveying and mapping only, on the six-inch scale, is but 2½ times the expense of that on the one-inch scale, and the cost of engraving and copper plates is only doubled—the areas of the published maps being, nevertheless, as 36 to 1.

The officers of the Ordnance Survey are, no doubt, the proper authorities to refer to for estimating the extra expenses of constructing the maps on a scale of three or four chains to an inch—that is, of twenty to twenty-seven inches

to the mile. But a sufficient approximation to that extra cost may readily be obtained by comparison and induction.

It has been already stated that the production of maps the scales of which are as 6 and 1, and consequently the areas as 36 and 1, has been effected at the comparative costs, for the surveying and mapping only, of $2\frac{1}{2}$ and 1, and for the engraving and copper plates separately, as 2 and 1; and it has also been previously shown that the actual cost of the surveys and maps only on the larger, that is, on the six-inch scale, has been about 7*d.* per statute acre, the expense of the engraving and of copper plates being 1*d.* per acre; the levels and contours separately costing $1\frac{1}{2}$ *d.* per acre, together 9 $\frac{1}{2}$ *d.* and, with some minor expenses, in the whole about 10*d.* per acre for the six-inch maps.

In the above 7*d.* per acre, for surveying and mapping only, the geodesic operations and triangulation are included; also the expenses of the whole of the organization and superintendence by the Ordnance staff. The cost of the triangulation is probably about 2*d.* per acre, as will appear by a comparison with the expense of the one-inch scale maps, which, in the aggregate, is 3 $\frac{1}{4}$ *d.* per acre. Hence the cost of mere field surveying and mapping by non-scientific labour, may be fairly taken at 5*d.* per acre.

Now, the cost of a first-class parochial map, on a scale of three or four chains to an inch, say from twenty to twenty-seven inches to the mile, as prepared by an expert civil surveyor, with minute computations of acreage and accompanied by a terrier, amounts to 9*d.* per acre; we therefore at once obtain the *maximum* additional cost of such surveys above that of the six-inch maps, by taking the difference between 5*d.* and 9*d.*,—viz., 4*d.* per acre. But, considering the perfectly organized arrangements and systematic division of labour by the Ordnance officers, it would seem doing them but scant justice to assume that their operations, on a large scale, would be at all so expensive as those carried on by a civil surveyor for an isolated parish map; and there can be no hesitation in concluding that the Ordnance staff may complete field surveys and maps on the scale of three or four chains to the inch 25 per cent. cheaper than the ordinary civil surveyors can do—that is, at the cost of 7*d.* per acre instead of 9*d.*, or at an additional expense of 2*d.* for the larger surveys above the cost of the six-inch maps, which have been shown to cost 5*d.* per acre.

In this way, the extra expense of surveying and mapping the whole surface of Scotland on a scale of three or four chains to an inch would be only 160,000*l.* If this should by some be considered too low an estimate, the mode I have adopted for arriving at it offers the greatest facility for calculating any addition thereto deemed necessary.

The extra expense of engraving the maps on this larger scale has not been estimated, because, although it might be found expedient to have such maps to refer to, it by no means follows that they should be engraved on so large a scale. This is, however, a separate branch of the inquiry. The present question is, “Assuming the extra expense to be as above worked out, or not very materially exceeding it, are the purposes to which the enlarged maps apply, of sufficient importance to justify the additional cost, and the departure from the six-inch scale, which otherwise unites the suffrages of so many in its favour?”

Without intending to raise any points of controversy, it may be reasonably affirmed that the time cannot be very distant when serious inquiries into taxation, as applied or as applicable to property in land, must be instituted; or if not with such peculiar object in view, that very minute information will be required by Parliament and Government in regard to the available resources of the United Kingdom; in fact, detailed statistical returns which can only be properly based on maps laid down to the larger scale under consideration: and it would appear well worth no small pecuniary outlay to ensure a safe groundwork for collecting officially such authentic materials as would lead to better and more equable distribution.

If ever the land tax in England should be equalized or readjusted, it could only be effected by means of maps on a scale sufficient to show small divisions of property.

Among the many purposes to which a very large scale of map, showing clearly the smallest holding, may be applied, there are none which would be so generally useful as those in reference to the parochial and county rates, and more especially the poor rates; endless litigation arises between parochial officers and public companies, such as those for railways, canals, gas, water-works, electric telegraphs, &c., as well as large establishments, such as breweries,

mines, &c., upon the fairness of the poor-rate assessment throughout the parish, besides the minor disputes between assessors and individuals not strong enough to try the question in a court of law, as a public body can. A perfectly accurate parochial plan on a large scale being on record, and made evidence as to quantities, &c., would afford means of information, and facility for inquiry and redress in cases of disputed valuation, at the same time tending greatly to improve the system of assessment. These remarks are not confined to rating purposes, but are applicable to all cases of litigation, of boundaries, rights of ways or of water, liability to repair old roads, &c.

Most countries of Europe have long paid great attention to their national surveys; Savoy, Piedmont, Italy, France, Bavaria, Baden, Württemberg, Saxony, Holland, Sweden, and, I believe, Austria, and Prussia, for several, if not for all, of these provinces, possess detailed maps; and surveys for such maps are rapidly extending over Western Russia.

These maps constitute in those countries the foundation of all proceedings respecting landed property, valuations, assignments, inheritance, registration, boundaries, arbitrations, assessments for local and general taxation, rights, statistics, &c. They are called "*cadastres*," literally "*terrier maps*." Had the art of surveying been properly understood at the period of the Norman conquest, we should probably have had a Saxon *cadastre* along with Domesday Book, as desirable an addition thereto as a modern *Domesday Book* would be to elucidate and accompany the present population returns, and the national surveys now contemplated.*

Prejudices in this country—perhaps to be traced back to the period above alluded to—seem hitherto to have interposed obstacles to the collection and record of authentic agricultural statistics, deeming the inquiries necessary to obtain them too inquisitorial. In the United States of America, very different opinions on this subject prevail; and for thirty years past, at the least, returns have been periodically made to Congress, of the internal resources of every district in the Republic, which give details of remarkable minuteness, not very dissimilar to those so much complained of in the Saxon chronicle.

It is perhaps enough to have alluded to fiscal and statistical purposes, and to name "registration of assurances," referred to by Lord Langdale in a note made some years back, without going further into arguments to show how national surveys on a large scale may be made to subserve the remaining important purposes in the preceding list, and perhaps others yet to be noted.

It may not be uninteresting, nor very irrelevant, to bestow a few remarks on the institution of national surveys, and the scales to which they are drawn.

The earliest surveys were not laid down as maps, but consisted of catalogues of property, which are called "terriers;" of these, Domesday Book is the earliest extant; little change seems to have been made until the early part of the 17th century, when simple boundary-line maps accompanied the terriers of the survey made in Ireland in 1634, by order of Lord Strafford, then Viceroy. Great improvements were introduced about that time in Sweden by Gustavus Adolphus, which must have become known to Cromwell; for in 1654, the "Down Survey," as it was called, comprised maps of the townlands and baronies over two-thirds of the surface of Ireland, that is, comprehending about 20,000,000 of English acres. Gradual improvements can be traced in the application of surveying to military and civil purposes, to mapping the campaigns of Louis XIV. and of Marlborough, and laying down the forfeited estates in Ireland by William III., until in 1729, the first national survey on a large scale, for public and private purposes, was commenced in Savoy and Piedmont by Victor Amadée II., whereon nine years were occupied.

* A.D. 1085.—"After this had the King a very large meeting, and a very deep consultation with his council about this land, how it was occupied and by what sort of men. 'Then sent he his men over all England, into each shire, commissioning them to find out 'how many hundreds of hides were in the shire; what land the King himself had, and what stock upon the land; or what dues he ought to have by the year from the shire.' Also he commissioned them to record in writing, 'How much land his archbishops had, and his diocesan bishops, and his abbots, and his earls;' and though I may be prolix and tedious, 'What and how much each man had, who was an occupier of land in England, either in money or in stock, and how much money it was worth.' So very narrowly indeed did he commission them to trace it out, that there was not a single hide nor a yard of land (the fourth part of an acre), nay, moreover (it is shameful to tell, though he thought it no shame to do it) not even an ox, a cow, or a swine was there left, that was not set down in his writ. And all the recorded particulars were afterwards brought to him."—*Saxon Chronicle*, by Ingram, p. 289.

"The extraordinary precision and minute details of this ancient work have scarcely been surpassed in modern times."—*Report from Select Committee on Survey and Valuation of Ireland*, 1824.

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The method of large surveys obtained the name of Cadastre (Terrier-map). It was suggested for France in 1763, but was only commenced in that country in 1793. It has since been extended to most parts of the Continent. In 1824 the system was applied to Ireland, pursuant to a Report of the Committee of the House of Commons, from which much of what is stated on this subject has been derived. It should be remarked that the recent Irish Ordnance Survey commenced with the boundaries of the townlands only ; but being found insufficient for the valuations, the divisions of fields, gardens, and holdings, were introduced; and those counties not so surveyed in the first instance are now in course of resurvey at great additional cost. Surveys and maps of the towns on an enlarged scale were also found necessary, and were executed.

The scales adopted for these national surveys appear in general to correspond nearly with the English scales of six, twelve, and twenty-four inches to the statute mile. The Continental geographers, even before the adoption of the decimal system of computation, were accustomed to express the scale in decimal fractions of the real length. The English and Irish systems of land measurement have usually been expressed in chains or in poles (perches) of which four constitute a chain ; the English pole consists of five-and-a-half yards, and the Irish pole of seven yards,—the maps being laid down on scales of a certain number of poles or chains to an inch. There are eighty chains in one mile. It will simplify and condense further explanations to put the different modes of expressing the scales into the following tabular form:—

SYSTEMS OF INDICATING SCALES OF MAPS.

CONTINENTAL.	IRISH.		ENGLISH.	
Proportion of lengths on Maps to the actual lengths on the ground.	Irish Perches to one inch.	No. of Inches to one Irish Mile.	Statute Chains to one Inch.	No. of Inches to one English Mile.
A { 1 to 63,360 " 50,000 " 31,680 " 15,840	200 about	1 $\frac{2}{3}$ nearly	80 63 (about) 40 20	I 1 $\frac{1}{4}$ (about) 2 4 } A
B { 1 to 10,560 " 10,080 " 10,000 " 9,504	40	8	13 $\frac{1}{3}$ 12 $\frac{72}{100}$ 12 $\frac{62}{100}$ 12	6 6 $\frac{28}{100}$ 6 $\frac{1}{3}$ 6 $\frac{2}{3}$ } B
C { 1 to 5,280 " 5,040 " 5,000 " 4,752	20	16	6 $\frac{2}{3}$ 6 $\frac{36}{100}$ 6 $\frac{31}{100}$ 6	12 12 $\frac{57}{100}$ 12 $\frac{2}{3}$ 13 $\frac{1}{3}$ } C
D 1 to 3,168			4	20 D
E { 1 to 2,640 " 2,520 " 2,500 " 2,376	10	32	3 $\frac{1}{2}$ 3 $\frac{18}{100}$ 3 $\frac{15}{100}$ 3	24 25 $\frac{14}{100}$ 25 $\frac{1}{3}$ 26 $\frac{2}{3}$ } E
F 1 in 1,056	4 nearly.	80 nearly.	88 feet to an inch.	60 F

The various scales in the preceding table have been grouped; scales smaller than any of these are only applicable to geographical and travelling maps, and do not come within the scope of this inquiry. The scales in Group A are for topographical and geological maps only.

Those in Group B are extensively useful for all purposes. To recommend the laying down of a national survey to a smaller scale, appears like taking a retrograde movement in science and statistics. It will be observed that the scales of this group vary only with the character of the measurements used in each country. Six inches to the mile and twelve chains to the inch are the popular expressions in England; forty perches to the inch is the well-known Irish description. On the Continent, the scale of the map is said to be as 1 to 10,000. Speaking broadly, the scales are all similar.

The scales in Group C are exactly double the corresponding ones in the preceding group.

The scales in Group D, E, and F are all large, for the purpose of showing small properties clearly.

The first of the scales in Group A is that on which the Ordnance maps of England and Wales have been hitherto published (except for the northern counties); and it is the scale recommended by the Committee of the House of Commons in July 1851, as the one on which the future Ordnance Surveys of Great Britain should continue to be mapped and published. The scale for maps of a corresponding character on the Continent would be as 1 to 50,000,

Among the scales in Group B is that on which the recent Ordnance Surveys of Ireland have been completed, and on which those for the northern counties of England and for Scotland have been commenced, popularly called the six-inch scale, that is, six inches to the statute mile. The scale of the "Down Survey" of Ireland under Cromwell (which was on forty perches to the inch) comes into this group. The scale of the published Cadastre of the Grand Duchy of Baden is here also, viz., 1 in 10,000, engraved on this scale after reduction from the originals on a much larger one.

The third scale in Group C is that on which the Cadastres of Bavaria, of Würtemberg, of France, and of some other States, are published, viz., 1 in 5,000, all of them reduced from the originals mapped on the double of that scale, viz., 1 in 2,500. It is to the scale of six chains to the inch that most of the parish maps of England are reduced when it is required to multiply copies of them for various local purposes. It is probable that on this account, as well as from the similarity of scale to the best published Cadastres of the Continent, that much stress has been laid by competent persons on the propriety of adopting this scale for engraving and publishing the Ordnance map of Scotland; some however, recommending the surveys to be plotted originally to the same scale, and some considering that the original maps should be plotted on double the scale, and be reduced for publication.

The one scale in Group D, of four chains to an inch, or twenty inches to the mile, is to be recommended, as being a multiple both of the chain-measure and of the mileage, as being more readily handled in reducing for publication, and more convenient for inspection and reference in the original, and being at the same time sufficient to show clearly and accurately every detail of property in nearly as satisfactory a manner as can be done on the larger scale of three chains to an inch, and being in some degree less expensive.

Of the scales in Group E, that of 1 in 2,500 is the one upon which the Cadastres of France, of Bavaria, of Würtemberg, and of other continental countries, are originally mapped. For the Ordnance Survey of Scotland, the scale of twenty-four inches to the mile in this group has been recommended, as being a multiple of the six-inch and of the twelve-inch scales. The nearly similar scale of three statute chains to the inch is that adopted for all the modern first-class parochial maps of Great Britain, and which has been most extensively used in tithe surveys, and for very many of the landed estates in the kingdom. Its value and importance in highly cultivated and thickly inhabited districts is undoubted, and it is very much esteemed for valuations.

The single scale in Group F, of sixty inches to the mile, is the one adopted for the Ordnance surveys of towns, in addition to the six-inch maps. It is an extremely appropriate scale for the purpose; but there are many populous places, large villages, and small holdings in the manufacturing and mineral districts, in every part of Great Britain, which for sanitary, fiscal, and social purposes, police

regulations, and so forth, it would be equally desirable to survey and map on this large scale: but where is it to stop? and how is the decision to be made as to these enlarged surveys being undertaken or not? On the Continent, the scale for the corresponding character of map would be 1 in 1,000. For sanitary purposes in very close-built localities, even this large scale is insufficient; but the measurements made for maps of sixty inches to the mile may be safely plotted on double the scale.

In concluding this portion of the subject, it may be observed that, on the Continent, the general absence of enclosures gives a different character to the maps from those in this country, where the divisions of holdings are not mere furrows, but close fences and hedges. In the published map of the Grand Duchy of Baden, the furrow-boundaries of the tenancies are not shown; for these, reference must be made to the original maps, which are very accessible. The published maps would have a bare appearance but for the contoured lines of heights, which express the undulations, clearly and simply, at every twenty feet difference of elevation.

In the published map of the kingdom of Würtemberg, the furrow-boundaries of every field and vineyard are shown, every yard and building; but the contouring was not finished a few years ago.

The chief argument in favour of publishing the Ordnance Survey of Scotland on the twelve-inch scale is, that it is large enough to show the small divisions of property, and the numbers for reference to the terriers—thus combining a general and an estate map. I apprehend the two objects are incompatible. The estate map must be on the large scale of at least twenty inches to the mile to ensure the purposes before mentioned. However, the reduction from this enlarged scale of three or four chains to an inch to the publication scale of six inches to the mile cannot be at all a costly operation, since it appears in evidence that the total cost of reducing the six-inch maps to the one-inch scale, together with the expense of engraving and putting in the hill-features of the country, by contour lines instead of by hatching, would only be 22,000*l.* for the whole of Scotland; and it is manifest that the mere reduction of the larger maps can form a very small portion only of the whole of this cost.

In respect to the contouring, I refer to my letter of July 1851, in which most of the arguments in favour of this operation have been stated.

I cannot believe that an operation which all the minor states on the Continent have justly considered as an indispensable portion of their national survey, for many purposes of public utility, will be abandoned by the Government of this country.

The organization and system of the modern Ordnance survey is most complete; but it will not be without interest to mention, as a remarkable feature of the “Down Survey” of Ireland, two centuries since, that soldiers were trained to do the field-details of the work, in the same manner that the privates of the corps of Royal Engineers have been trained to operate in the present day.

In venturing to add my humble tribute of admiration at the perfect manner in which all the operations of the Ordnance surveys are conducted, I do but echo the sentiments of every civil engineer, whose only differences of opinion on this subject are as to the scale on which the surveys should be laid down, and as to how far the Government ought to interfere with what it has hitherto been the custom, in this country, to leave to the unaided efforts of individuals and private associations.

For my own part, I hold that Government ought to effect the national surveys on a scale sufficient for all present and all probable future purposes, public and private; and this has long been the opinion of unprofessional persons and statesmen. When Mr. Croker, then Secretary to the Admiralty, was examined before the Committee on the Survey of Ireland in 1824, he expressed himself to the following effect, condensing into a few terse observations the whole case. He says:—

“Great expenses must have been incurred by endeavouring to perform by so many different means what ought to be a single undertaking. Immense expenses are incurred for local maps, and the principles are unsatisfactory on which they are executed.

“Although all these separate expenses appear to come from different sources, some of them apparently of a private nature, yet it is evident that ulti-

mately the whole expense falls upon the country; and it would therefore be much better that a general and scientific survey should be conducted at the public expense, which might afterwards be applied to every purpose of civil and military engineering of maritime charts, *of local plans, and all the other purposes* to which the survey of a country can be applied."

Having thus fully set forth the foundations on which I base my opinion, I will briefly express my conclusions as to the mode and the scale on which the national survey should be laid down, so as to be most available for all the important purposes to which it can and might be applied, viz.:—

1. The measurements should be taken with sufficient exactness to be accurately laid down, in general, to a scale of four chains to an inch, or twenty inches to a mile, except in the mountain districts, where the six-inch scale should be adopted.

2. All original maps to be preserved for reference.

3. The system of surveying and mapping towns and their suburbs to the scale of sixty inches to the mile should be extended to every populous place in the manufacturing and mineral districts; and in closely-built localities to double that scale.

4. The whole of the survey should be engraved for publication on a scale of six inches to the mile.

5. The original maps on the scale of four chains to an inch to be only engraved or lithographed when parties interested in any particular parish or district subscribe for the separate expense of so doing.

6. The system of contouring to be continued, and the contours engraved on the six-inch map.

7. That it shall be left to the judgment of the Ordnance officers to decide to what extent in the mountainous and uncultivated districts the measurements be limited for laying the maps down to the six-inch scale only; and that in like manner, it be left to their judgment to settle the height at which the contouring should terminate.

8. One-inch topographical maps to be engraved and published, and the hills and undulations to be defined thereon by contour lines, and not by vertical hatching.

No. 9.

J. W. LEATHER, Esq., to Sir C. TREVELYAN.

Leeds, March 24, 1853.

A severe domestic affliction must be my apology for not having earlier replied to your communication of the 16th instant, wherein you ask my opinion as to whether it would or would not be desirable to adopt twelve inches to a mile instead of six, as the scale for the Ordnance survey.

I now beg to say that, in my judgment, the scale of six inches to the mile is sufficiently large for all general purposes, and I do not see that any important *public* objects would be better subserved by making the plotting of the survey occupy four times the recently adopted area, which (be it remembered) was already thirty-six times larger than that originally contemplated.

If so large a scale as *twelve* inches to the mile were entertained, I would suggest for consideration whether six chains to the inch (or thirteen and one-third inches to the mile) would not be more desirable, as being the scale required by Parliament for certain deposits under their Standing Orders, and an exact multiple also of the scale of three chains to the inch (or twenty-six and two-thirds inches to the mile) required by the Tithe Commutation and Enclosure Commissioners; for, as the surveying or out-door department must be executed with equal minuteness for twelve inches as for thirteen and one-third inches to the mile, the only additional expense would be in the small additional surface of plates and paper, which would be comparatively trifling.

For some of the thickly peopled manufacturing districts, no doubt this large scale would be highly useful; but for rural districts, the scale of six inches to the mile is ample, and even more than sufficient, for all purposes.

The maps at one inch to the mile are highly valuable and useful, and will, I trust, be continued without further delay, even where a larger scale has been adopted.

W. M. RANKINE, Esq., to Sir C. TREVELYAN.

59, St. Vincent Street, Glasgow, March 11, 1853.

I have had the honour of receiving your letter of the 10th instant, relative to the scale of the Ordnance survey.

The opinion which I expressed to Captain Gosset, R.E., in my letters of the 11th June and 12th July, 1851, in favour of the scale of six inches to one mile, were founded on my experience of the use of the Ordnance maps of Ireland in enabling engineers to select the best and most economical lines for works of public improvement, and to judge of their practicability and cost, preliminary to taking steps to carry them into execution.

For these purposes, so far as I can judge, the scale of six inches to a mile is the best, as it enables all streams, roads, buildings, and other topographical features to be shown in their natural proportions, and with sufficient precision for the purpose in view; and at the same time is not inconveniently large.

I conceive that the scale of twelve inches to a mile would be inconveniently large for such purposes, except in a very few populous districts in the mining and manufacturing counties; while it would be too small to be used in the execution of works, except in some of the least populous rural districts.

So far, therefore, as my experience enables me to form an opinion, I consider that for engineering purposes the scale of six inches to a mile is preferable to the scale of one foot to a mile.

The only purpose for which I can conceive that the scale of one foot to a mile would be superior, is that of furnishing landowners with plans of estates; but of this I am, of course, less qualified to judge than of the points above referred to.

I need scarcely add that none of the preceding remarks are applicable to towns, for which the proposed scale of five feet to a mile is by no means too large; while for some closely built and thickly peopled towns, such as Manchester and Glasgow, even this scale is too small, and a scale of ten feet to one mile is requisite.

R. VANS AGNEW, Esq., to Sir C. TREVELYAN.

Malvern, March 16, 1853.

In reply to your letter of the 10th instant, on the subject of the scale for the Ordnance maps, I have to state that until its receipt two days ago I had not considered the merits of a scale of twelve inches to a mile.

I am still of opinion that a six-inch is preferable to a one-inch scale, and there is no doubt that for many of the purposes for which the former is better than the latter, a still larger scale is superior in an increased ratio.

I allude to such uses as the accurate marking of lines of road, streams, fences, boundaries of property, &c.

Looking, however, to the length of time that has been occupied in the small proportion of the survey already completed, the increased expense that the larger scale would require, and the amount of the Parliamentary grants for the purpose, I would deprecate any increase of the scale beyond six inches to a mile.

A reduced map of one inch to a mile *in addition* would also be very useful for those objects for which the size of the larger scale renders it inapplicable.

There is one other suggestion which I beg leave to make. In the maps of Wigtownshire, there are whole sheets almost entirely occupied by tracts of sheep-walks, mere moorland. There is a greater proportion of this kind of ground in many other counties, where it is not even enclosed. It has been mapped in Wigtownshire as minutely as the more populous and enclosed districts. I would suggest that in future merely the watercourses, fences (if any), and general features of such ground should be preserved, and all the minute detail, such as

blocks of stone, ruins of sheep pens, &c., omitted. Should any contouring be retained (and I should be sorry to see it given up), a few lines in the most marked directions would be sufficient.

By thus making skeleton maps of these wild districts, much expense, both in surveying and engraving, may be saved, and they may be issued at a lower price.

No. 12.

J. F. BATEMAN, Esq., to Sir C. TREVELYAN.

Manchester, March 29, 1853.

Absence from home has prevented my answering your letter of the 10th instant earlier. I am of opinion that the Ordnance survey laid down upon a scale of twelve inches to the mile instead of six would not be so convenient as that now adopted. It would be too large for general purposes, and would not show a sufficient extent of country in each map to render it convenient for the uses to which a national survey would be most commonly applied. I consider the six-inch scale all that can be desired, and I am in the habit of using it for parliamentary and general purposes very extensively.

No. 13.

PHILIP PARK, Esq., to Sir C. TREVELYAN.

Preston, March 14, 1853.

In reply to your letter of the 10th instant, relative to the Ordnance survey of the northern counties of England and Scotland, I am of opinion that the six-inch scale is sufficiently large for all national purposes; at least, for all such as have come within my experience. For Parliamentary purposes (for which these maps are now frequently used), this scale complies with the Standing Orders of the two Houses.

I fear the twelve-inch scale would be too bulky for general use, and still not large enough to measure off details or contracts. It would not, in my opinion, be desirable to adopt the twelve-inch scale instead of the six for national purposes.

Allow me to say, the one-inch Ordnance maps are very useful documents, and should generally accompany the six-inch maps.

No. 14.

C. PIAZZI SMYTH, Esq., to Sir C. TREVELYAN.

Royal Observatory, Edinburgh, March 15, 1853.

In answer to yours of the 10th instant, inquiring my opinion of the relative advantages of the six inches to a mile and twelve inches to a mile scales for the maps of the Ordnance survey, I beg leave to say, that I have frequently considered the subject of scales greater and smaller than six inches to a mile, and that I have found this one, viz., the six-inch, to be the smallest possible one that can be employed, compatible with some of the more important requisites (as the registration of property) which a national survey should subserve, and which alone can justify the Government embarking in such an undertaking.

But if the six-inch be barely large enough now, there can be no doubt that in a few years it will be found decidedly too small; and a larger map will then be required on account of the general increase in the value of property which will doubtless take place, the greater number of buildings, the extension of draining and mining operations, and the greater exactitude required in engineering works employed for many of the common purposes of life, as in the formation of lines of railway in place of ordinary roads.

Memoranda
and
Correspondence.

We find, moreover, on looking back to the maps of the country in past ages, that the invariable effect of the progress of time has always been to demand greater and greater size and accuracy in all plans and charts; so that, infallibly, if a scale be decided on now barely large enough for present practical purposes, it will be so incapable in a few years that another survey of the country will have to be executed.

But this will be the very worst economy: the survey, once made, should last and be useful for ages; and it may do so, if the Government will merely consider the necessities of the next, in addition to those of the present generation.

In such a case, there can be no hesitation in preferring the scale of twelve inches to a mile to the six-inch; and while the former will be indispensable to the next age, it will also be pregnant of benefits to the present, in the greater exactitude and certainty which will be introduced into the various public works of the country.

LETTER from the TREASURY transmitting the foregoing Correspondence.

Circular Letter
from the Treasury.

(Circular.)

Treasury Chambers, April 16, 1853.

THE accompanying correspondence and memoranda describe—first, the grounds upon which it was determined, in 1840, to publish the Ordnance Map on the scale of six inches to the mile for the country, and five feet to the mile for towns; and secondly, the opinions now given on the question, whether the purposes which a National survey ought to subserve would be more fully provided for by an increased scale; and how far such increased scale would involve increased expense.

The Lords Commissioners of Her Majesty's Treasury request that after having attentively read these papers, you will state, in the annexed form, what scales you would recommend for any National surveys which may henceforward be carried on at the public expense; and that you will add any special observations you may have to make in support of your opinions.

It is assumed that the results of the Ordnance Survey will, under any circumstances, be separately published on the reduced scale of one inch to the mile; and the question upon which an opinion is solicited is merely between the scale of six inches and any larger scale.

(Signed) C. E. TREVELYAN.

ABSTRACT of Replies to the Treasury Circular, 16th April 1853.

Abstract of Replies
to the Treasury
Circular.

- 1.—In favour of the Six-inch Scale.
- 2.—In favour of other Scales.

1.

IN FAVOUR OF THE SIX-INCH SCALE.

No. in Series	Treasury Register Number.	Date.	Party replying.	Scale recommended.			
				Rural Districts.		Towns.	
				Draft.	En- graved.	Draft.	En- graved.
		1853.		Inches to a Mile.			
1	8,946	2 May	Hon. T. F. Kennedy, Commissioner of Woods, &c.	6	1	60	—
2	8,947	" "	Mr. A. Keith Johnston - - -	6	1	—	—
3	9,119	4 "	Vice-Chancellor Stuart - - -	6	1	—	—
4	9,304	6 "	Commissioners of Supply, Clackmannan- shire.	6	6	—	—
5	9,412	7 "	Secretary to Society of Arts - -	6	6	60	60
6	9,423	" "	Messrs. Stewart and Kincaid - -	(6 or 8)	—	(60 or 80)	—
7	9,426	" "	Commissioners of Supply, Banffshire	6	—	60	—
8	9,542	9 "	Commissioners of Supply, Elgin	6	1	—	—
9	9,543	" "	Commissioners of Supply, Stirling	6	6	120	60
10	9,547	" "	Commissioners of Supply, Ross-shire	6	—	—	—
11	9,548	" "	Commissioners of Supply, Caithness	6*	1*	60*	6*
12	9,594	10 "	Mr. William Chadwell Mylne - -	6	—	60	—
13	9,595	" "	Mr. Charles Rowcliffe - - -	6	1	60	10
14	9,805	12 "	Mr. James M. Rendel - - -	6	1	(†)	—
15	9,830	" "	Sir Philip Egerton, Bart., M.P. -	6	1	—	—
16	9,900	13 "	The Lord Provost of Edinburgh -	6	6	60	60
17	10,084	" "	Sir James Matheson, Bart., M.P.	6	1	120	—
18	10,344	19 "	The Principal of Glasgow College	6	1	24	12

• "Not less than."

† To be varied according to the size of the towns.

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Abstract of Replies
to the Treasury
Circular.

1. In favour of the Six-inch Scale—*continued.*

N o. in Series	Treasury Register Number.	Date.	Party replying.	Scale recommended.			
				Rural Districts.		Towns.	
				Draft.	En- graved.	Draft.	En- graved.
		1853.		Inches to a Mile.			
19	10,565	21 May	Admiral Sir F. Beaufort, K.C.B., Hydrographer - - - }	-	6	-	-
20	10,568	" "	Commissioners of Supply, Zetland -	6	-	60	-
21	10,608	" "	Town Council of Perth - - -	6	-	60	-
22	10,655	23 "	Professor Forbes - - -	6	1	-	-
23	10,890	27 "	Mr. David Stevenson - - -	-	6	-	-
24	11,488	3 June	The Deputy Clerk Registrar -	6	-	60	-
25	12,917	23 "	Commissioners of Supply, Buteshire -	6	6	-	-
26	14,064	8 July	Mr. G. B. Greenough - - -	6	6	-	-
27	15,251	25 "	Sir Denham Norreys, Bart., M.P. -	6	-	132	-
28	17,693	27 Aug.	Mr. A. Hunter - - -	6	6	120	60
29	17,960	31 "	Mr. J. F. Bateman - - -	6	6	60	60
30	17,961	" "	The Provost of Wigtown - - -	6	1	60	60
31	18,129	2 Sept.	Mr. John Dickson - - -	6	6	60	60
32	19,711	30 "	Mr. William Fairbairn - - -	6	6	60	60

2.

IN FAVOUR OF OTHER SCALES.

		1853.		Inches to a Mile.			
1	8,548	26 April	The Registrar General - - -	24	12	120	60
2	8,562	" "	President of the Geographical Society -	24	12	-	-
3	8,567	" "	Mr. H. Bellenden Ker - - -	(a)	6	(a)	60
4	8,732	28 "	Lord Beaumont - - -	26 $\frac{2}{3}$	12	(b)	60
5	8,736	" "	Mr. A. M. Dunlop, M.P. - - -	26 $\frac{2}{3}$	13 $\frac{1}{3}$	120	120
6	8,737	" "	Mr. E. Ellice, jun., M.P. - - -	26	1	-	-
7	8,811	29 "	Copyhold, Inclosure, and Tithe Commissioners.	26 $\frac{2}{3}$	26 $\frac{2}{3}$	120	-
8	8,948	2 May	Mr. G. S. Duff, M.P. - - -	24	12	120	60
9	8,949	" "	Mr. Richard Hall, Land Agent - - -	20	10	80	40
10	8,950	" "	Mr. J. Lancaster, Land Agent - - -	24	6	120	60
11	9,001	3 "	Commissioners of Supply, Kirkcudbright -	12	6	120	60
12	9,002	" "	Rev. R. Jones, Cathedral Commission -	26 $\frac{2}{3}$	26 $\frac{2}{3}$	-	-
13	9,003	" "	Commissioners of Supply, Aberdeenshire -	24	6	120	60
14	9,079	4 "	Mr. J. Duff, M.P. - - -	24	12	120	60
15	9,115	" "	Mr. J. M. Herbert, Judge of County Court.	24	12	120	60
16	9,116	" "	Commissioners of Supply, County of Lanark.	24	12	-	-
17	9,118	" "	Commissioners of Supply, Argyllshire -	13 $\frac{1}{3}$	6	-	-
18	9,120	" "	Mr. J. T. Danson, Barrister-at-Law -	26 $\frac{2}{3}$	13 $\frac{1}{3}$	-	-
19	9,121	" "	Pickering and Smith, Estate Agents -	20	8	60	60
20	9,122	" "	Sir Henry T. De la Beche, C.B. - - -	24	12	120	12
21	9,123	" "	R. J. and H. Clutton, Estate Agents -	20	8	60	60
22	9,124	" "	Sir W. C. Trevelyan, Bart. - - -	24	6	120	60
23	9,125	" "	Mr. Charles Bailey, Land Agent - - -	26 $\frac{2}{3}$	13 $\frac{1}{3}$	80	40
24	9,301	6 "	Lord Rosebery - - -	24	6	120	60
25	9,302	" "	Mr. I. K. Brunel, Mr. R. Stephenson, M.P., and Mr. J. Locke, M.P.	20	1	20	-
26	9,303	" "	Mr. A. C. Ramsay, Director of Geological Survey.	24	12	-	-
27	9,424	7 "	Commissioners of Supply, Fifeshire -	26 $\frac{2}{3}$	13 $\frac{1}{3}$	-	-
28	9,425	" "	Chairman of Quarter Sessions, Haddington -	12	6	60	60
29	9,532	9 "	Mr. E. W. Wilmot, Estate Agent - - -	24	6	60	60
30	9,533	" "	Lord Hatherton - - -	24	-	120	24
31	9,534	" "	Commissioners of Supply, Perthshire -	12	6	-	-
32	9,535	" "	Mr. George Dundas, M.P. - - -	24	6	120	60
33	9,536	" "	Provost of Dundee - - -	12	6	264	132
34	9,537	" "	Mr. Jonatham Pim - - -	24	6	120	60
35	9,541	" "	Commissioners of Supply, Berwickshire -	24	6	120	60
36	9,544	" "	Trustees of the Harbour, Dundee - - -	12	6	264	132
37	9,545	" "	Mr. J. Hope, Deputy Keeper of the Signet -	24	12	120	60
38	9,546	" "	Daniel Smith and Son, Land Agents -	26 $\frac{2}{3}$	-	-	-
39	9,550	10 "	President of the Geological Society -	24	12	-	-

(a) The largest convenient scales.

(b) "The larger the better."

2. In favour of other Scales—*continued.*Abstract of Replies
to the Treasury
Circular.

No. in Series	Treasury Register Number.	Date.	Party replying.	Scale recommended.			
				Rural Districts.		Towns.	
				Draft.	En- graved.	Draft.	En- graved.
		1853.		Inches to a Mile.			
40	9,596	10 May	Mr. Thos. Smith Woolley, Land Agent -	24	12	120	60
41	9,703	11 "	Commissioners of Supply, Linlithgowshire	24	6	120	60
42	9,704	" "	Davis and Vigers, Land Agents -	24	12	120	60
43	9,713	" "	Mr. S. Eddy, Land Agent -	24	6	120	60
44	9,720	" "	Society for promoting the Amendment of the Law.	26 $\frac{2}{3}$	13 $\frac{1}{3}$	120	60
45	9,733	" "	Mr. C. L. Bradley, Land Agent. -	26 $\frac{2}{3}$	13 $\frac{1}{3}$	80	60
46	9,740	" "	Mr. S. Vessey, Land Agent and Valuer -	26 $\frac{2}{3}$	—	—	—
47	9,804	12 "	Mr. James Johnstone, M.P. -	24	1	—	—
48	9,878	13 "	Commissioners of Supply, Dumfriesshire	26 $\frac{2}{3}$	6	—	—
49	9,899	" "	Mr. A. E. Lockhart, M.P. -	24	12	120	60
50	9,914	" "	Commissioners of Supply, Roxburghshire	24	12	(a)	(a)
51	9,970	14 "	Metropolitan Commissioners of Sewers	—	—	120	120
52	10,056	16 "	Ecclesiastical Commissioners -	20	8	60	60
53	10,083	" "	Viscount Ebrington -	24	12	120	24
54	10,212	17 "	Mr. John Meadows White -	26 $\frac{2}{3}$	26 $\frac{2}{3}$	120	120
55	10,259	18 "	Mr. Charles Neale, Land Agent and Valuer	26 $\frac{2}{3}$	13 $\frac{1}{3}$	80	40
56	10,566	21 "	Mr. Thomas Sopwith -	40b	—	40b	—
57	{ 10,080 10,567	{ 16 " 21 " }	Commissioners of Supply, Dumbarton- shire.	24	12	120	60
58	10,569	" "	Commissioners of Supply, Renfrew -	(c)	(d)	—	—
59	10,595	" "	Poor Law Board -	26 $\frac{2}{3}$	—	(40 or 80)	—
60	10,672	" "	Local Director, Geological Survey of Ireland.	24	6	—	—
61	10,845	26 "	Mr. A. Smollet, M.P. -	24	12	120	60
62	10,888	27 "	Colonel Hunter Blair, M.P. -	24	6	120	60
63	10,888	" "	Commissioners of Supply, Ayrshire -	24	6	120	60
64	10,889	" "	Lieut.-General Arbuthnot, M.P. -	24	6	120	60
65	10,953	28 "	Highland and Agricultural Society -	(e)	(e)	—	—
66	10,996	30 "	Mr. J. E. Elliot, M.P. -	24	12	(f)	—
67	11,166	31 "	Lord Wrottesley -	(24 to 26 $\frac{2}{3}$)	—	(60 to 120)	—
68	11,326	1 June	Commissioners of Supply, County of Edinburgh.	26 $\frac{2}{3}$	1	—	—
69	11,857	8 "	Commissioners of Supply, Kincardine -	20g	6	60	30
70	11,889	" "	Duke of Devonshire -	20	12	60	60
71	11,934	9 "	Commissioners of Supply, Peebles -	24	12	120	60
72	11,953	" "	Sir G. G. Montgomery, Bart., M.P. -	24	12	120	60
73	11,998	10 "	Commissioners of Supply, Nairnshire -	26 $\frac{2}{3}$	1	120	1
74	12,189	13 "	Chancellor of the Duchy of Lancaster -	24	12	120	60
75	12,190	" "	Messrs. Stevenson, Salt, and Sons -	24	12	120	60
76	12,204	" "	Magistrates and Town Council, Aberdeen	24	6	120	60
77	12,237	14 "	Lord Lovat -	24	12	120	60
78	12,347	16 "	St. Andrew's University -	24	12	120	60
79	12,611	20 "	Board of Supervision, for Relief of the Poor.	26 $\frac{2}{3}$	1	120	60
80	12,962	24 "	Lieut.-Colonel Hon. L. Maule, M.P. -	24	12	60	60
81	13,239	29 "	The Earl of Rosse -	20	1	60	60
82	13,327	30 "	Mr. Walter Coulson, Q.C. -	26 $\frac{2}{3}$	26 $\frac{2}{3}$	120	120
83	14,003	7 July	Marquis of Tweeddale -	24	1	—	—
84	14,418	14 "	Hon. Charles Gore, Commissioner of Woods, &c.	26 $\frac{2}{3}$	8	60	60
85	15,252	25 "	Sir David Brewster -	12	6	120	60
86	15,312	26 "	Mr. E. H. J. Craufurd, M.P. -	24	6	120	60
87	15,449	27 "	Mr. James MacGregor, M.P. -	20	1	60	20
88	15,554	29 "	The Lord Advocate -	24	12	120	120
89	15,801	1 Aug.	The Rev. Dr. Dewar, Principal of Aber- deen University.	12	6	120	60
90	16,064	4 "	Mr. Thomas Huskinson, Estate Agent -	26 $\frac{2}{3}$	13 $\frac{1}{3}$	120	60
91	16,338	9 "	Mr. A. Doull, Civil Engineer -	24	24	120	120
92	16,497	11 "	Mr. J. Macquorn Rankine, Civil Engineer, &c.	24	6	60h	60h

(a) "Larger than 5 feet."

(b) A measured skeleton triangulation only.

(c) As large as can be granted.

(d) Such as to admit of accurate admeasurement of the areas.

(e) "Larger than 6 inches."

(f) "Larger than 5 feet."

(g) Not less than 20 in low country and 6 in hill country.

(h) "120 in special cases."

Abstract of Replies
to the Treasury
Circular.

3. In favour of other Scales—*continued.*

No. in Series	Treasury Register Number.	Date.	Party replying.	Scale recommended.			
				Rural Districts.		Towns.	
				Draft.	En- graved.	Draft.	En- graved.
		1853.			Inches to a Mile.		
93	16,809	16 Aug.	Mr. Thomas Woolcombe -	$26\frac{2}{3}$	$13\frac{1}{3}$	120	60
94	17,450	23 "	Mr. Philip Park, Civil Engineer -	24	6	120	60
95	17,451	" "	Professor Smyth, F.R.S.L. & E., &c. -	24	12	240	120 ^a
96	17,622	" "	Mr. James Jerwood -	$13\frac{1}{3}$	$13\frac{1}{3}$	120	—
97	17,796	29 "	Mr. James Forsyth -	24	12	120	60
98	17,815	" "	Mr. Lewis D. B. Gordon -	24	12	120	60
99	17,962	" "	Mr. Robert Dawson -	$26\frac{2}{3}$	—	—	—
100	18,128	2 Sept.	Mr. R. B. Grantham -	24	12	120	60
101	18,268	3 "	Colonel Stopford Blair -	24	6	120	60
102	18,346	6 "	Mr. H. McLauchlan -	24	12	120	60
103	18,403	7 "	Mr. James J. Beattie -	20	5	$105\frac{3}{5}$	$52\frac{1}{5}$
104	18,546	10 "	Mr. J. R. Wright -	24	12	120	60
105	18,568	" "	Mr. J. H. Williams -	24	12	120	60
106	18,647	12 "	Mr. W. Ranger, C.E. -	12	6	120	24
107	18,775	14 "	Mr. William Murton -	24	12	—	—
108	18,854	15 "	Messrs. Fox, Henderson, & Co. -	$26\frac{2}{3}$	$13\frac{1}{3}$	240	120
109	19,264	22 "	Mr. Charles Osborn -	24	12	120	60
110	19,325	23 "	Viscount Dalrymple, M.P. -	20	12	60	—
111	19,545	28 "	Commissioners of Supply, Forfarshire -	(b)	6	—	—
112	19,712	30 "	Mr. G. W. Carrington -	24	12	96	48
113	20,265	10 Oct.	Mr. J. W. Nicol -	24	6	—	—
114	20,513	14 "	Mr. W. E. Gaine -	24	12	120	120
115	20,514	" "	Mr. Lucius H. Spooner -	20	1	—	—
116	21,514	28 "	The General Board of Health -	24	24 & 6	120	120
117	21,515	" "	Mr. John Mc Millan -	(c)	(c)	—	—
118	22,233	5 Nov.	The Statistical Society -	$25\frac{1}{3}$	$12\frac{2}{3}$	$126\frac{2}{3}$	$63\frac{1}{3}d$
119	23,345	22 "	Mr. James W. Higgins -	24	12	120	60
120	20,825	18 Oct.	Statistical Conference -	$25\frac{1}{3}$	$25\frac{1}{3}$	$126\frac{2}{3}$	$126\frac{2}{3}d$

(a) "120 for first-class towns, 60 for second-class towns."

(b) As large as will render it available, and useful, for plans of estates, railways, &c.

(c) Large enough to give correct measurements of fields, &c.

(d) The ratios recommended correspond with these fractions of inches very nearly.

R E P L I E S

IN FAVOUR OF

T H E S I X - I N C H S C A L E .

No. 1.

THE RIGHT HON. T. F. KENNEDY, COMMISSIONER OF WOODS, &c.

Replies to the
Treasury Circular
in favour of the
six-inch scale.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	6
Such plans to be engraved and published in the same } manner as in Ireland, and - - - - - }	
A reduced map to be published, as in Ireland, on a scale of -	1
For draft plans of towns for record, the same as in Ireland -	5 feet.
(Where the towns are of such magnitude as to warrant such an undertaking, say upwards of 10,000 inhabitants, and in all towns which return, or contribute to return, Members to Parliament, in which cases the limits of the large scale to be the parliamentary boundary.)	

SPECIAL OBSERVATIONS.

Office of Woods, &c, April 29, 1853.

I think that a larger scale than six inches to a mile in rural districts would not be justifiable, on the score of expense, and on the ground that a landed proprietor would wish to have a very accurate map of his estate. I do not think that a private object of this kind ought to be attained at the public expense, while every landed proprietor would procure a most useful map of his estate from a six-inch scale, and *that* I think a fair line of demarcation between the interests of individuals and the principles which ought to regulate public expenditure in the performance of a highly interesting service to the Kingdom at large. I found my opinion on the attention which I paid to the subject while resident in Ireland.

No. 2.

MR. A. KEITH JOHNSTON.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records -	-
For plans to be engraved for sale -	-
For draft plans of towns for record -	-
For plans of towns to be engraved for sale -	-

SPECIAL OBSERVATIONS.

Edinburgh, April 28, 1853.

Having, as requested, carefully perused the papers which accompanied your letter of the 18th instant, on the subject of the Ordnance Survey, I now beg to offer my opinion as to the proposed enlargement of scale for the National Map.

Conceiving the ultimate production of a perfect map on the scale of one inch to a mile to be the primary and most important object of the great triangulation, I question whether this could be satisfactorily accomplished if the survey were, as suggested, to be protracted to a scale of 24 or 26 $\frac{3}{4}$ inches to a mile; for *accurately* to diminish the drawing for the published map to a twenty-fourth or twenty-sixth part of the original would involve a serious

Replies to the
Treasury Circular
in favour of the
six-inch scale.

practical difficulty, since in the repeated reductions to which it would be subjected, it would, notwithstanding the utmost care, undergo an amount of distortion by which its distinctive character would be lost; besides this, the amount of detail on the larger survey would be so great as to necessitate a selection of a portion of the lines and objects for the one-inch map, an operation which would lead to great uncertainty and confusion. The present scale of six inches admits of the reduction to one inch by a single operation, and thereby avoids one fertile source of error. It is, therefore, as large as is compatible with reduction to one inch by mechanical means, where accuracy is required.

Again, the chief argument against the *publication* of the survey on the six-inch scale, in Scotland at least, was, its interference with the means at the disposal of the Ordnance for the production of the one-inch map; now, this argument applies with greatly-increased force to the proposed publication on the scale of twelve inches; for, as the expense and consequently the time required for its completion would be much increased, so in the same ratio would the publication of the "indispensable" one-inch map be delayed.

These practical considerations appear to me important reasons against the proposed enlargement of scale, unless a double survey be contemplated; but even if it were practicable, it remains to be considered in how far it would be desirable to double the bulk, the inconvenience and the expense of the general plans without, after all, attaining any certain benefit. A scale of twelve inches would not, any more than one of six inches, answer all the purposes for which a survey is required; and, however desirable it might be to render the triangulation available for the protraction and drawing of the survey on the large scale proposed, as a National document for reference, it is to be feared that its adoption would virtually imply the abandonment of the one-inch map, in so far as the present generation is concerned. For these reasons, in addition to the consideration that the Ordnance Surveyors are *au fait* at their present kind of labour, and that any change in their system would cause further delay, I am of opinion that the survey should continue to be *protracted* on the scale of six inches to a mile, even in the Highland districts. With regard to the *publication* of the survey, my views are unchanged; namely, that the one-inch map is the great desideratum, and that the six-inch outline plans, as a publication, will not subserve any great public purpose.

Allow me, therefore, to repeat my earnest desire to have the one-inch map of Scotland carried on with all possible speed, in a style of excellence worthy of the age; and to urge the adoption of the plan suggested by Lieut.-Colonel Dawson for the training of hill sketchers and hill engravers to the peculiar duty required of them.

Edinburgh, 4, St. Andrew Square, September 14, 1853.

If not too late you will oblige me by appending to my reply to the recent Circular letter on the Ordnance Survey of Scotland, the following *correction* on the Minutes of Evidence taken before the Committee of 1851. In answer to question 491, I am reported to have said that estate plans in Scotland are surveyed on the scale of "two to four inches to the mile," instead of *two to four CHAINS to the INCH*, as stated by me.

Throughout the Lowlands of Scotland the surveys of estates are, and have long been, protracted from a scale of four chains to the inch. This is the common practice, the exceptions being in the case of small properties, when two chains to the inch is the usual scale. In Highland or muirland countries the scale is usually eight chains to the inch.

No. 3.

THE VICE-CHANCELLOR STUART.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts as public records	-	- 6 at the utmost.
For plans to be engraved for sale	-	- 1
For draft plans of towns for record	-	-
For plans of towns to be engraved for sale	-	-

SPECIAL OBSERVATIONS.

Replies to the
Treasury Circular
in favour of the
six-inch scale.

19, Hertford-street, Mayfair, May 3, 1853.

Minute details and subdivisions are so constantly varying, that a map on so large a scale as that its value should consist in representing minute objects, would, in the lapse of a few years, lose that value, and would probably mislead those who trusted it.

Where there are existing disputes as to the boundaries of private property, a map on the very large scales suggested would occasion great difficulty and inconvenience.

The attempt to define minutely the boundaries of private property would probably occasion many disputes, and give rise to much litigation, or occasion great injustice. The actual use of the enormous scales proposed for purposes of local assessments, sanitary improvements, &c., would only extend to a comparatively few districts, and the conjectural utility for other districts would not, I think, justify the delay and expenses.

No. 4.

COMMISSIONERS OF SUPPLY, CLACKMANNANSHIRE.

RECOMMENDED.

	Inches to a mile.		
For draft plans of rural districts as public records	-	-	6
For plans to be engraved for sale	-	-	6 and 1
For draft plans of towns for record	-	-	-
For plans of towns to be engraved for sale	-	-	-

SPECIAL OBSERVATIONS.

Copy Minutes of Meeting of the Justices of the Peace and Commissioners of Supply of Clackmannanshire, 30th April 1853.

The clerk then stated to the Meeting that he was directed by Mr. Johnstone of Alva, to bring under their notice the present Ordnance Survey of the county; and the Meeting having considered the subject, agree to recommend the scale of six inches to the mile for rural districts, to be preserved as public records, and for the plans to be engraved for sale six inches and one inch, and direct the clerk again to bring under the notice of the Lords Commissioners of Her Majesty's Treasury the memorial which was presented last year on the subject:

That the survey and plans be completed with the least possible delay, and that all the counties in Scotland should be on one and the same scale.

Adopted and desired to be signed by the Meeting of Justices of the Peace and Commissioners of Supply of Clackmannanshire, at their meeting of 30th April 1853, by

ROBERT BRUCE,
Præses, and Convener of Clackmannanshire.

No. 5.

SECRETARY TO THE SOCIETY OF ARTS.

RECOMMENDED.

	Inches to a mile.		
For draft plans of rural districts, as public records	-	-	-
For plans to be engraved for sale	-	-	-
For draft plans of towns for record	-	-	-
For plans of towns to be engraved for sale	-	-	-

SPECIAL OBSERVATIONS.

Adelphi, London, May 6, 1853.

I have read the printed papers respecting the Ordnance Survey Maps, and carefully considered the questions contained in your letter of the 16th ultimo.

Replies to the
Treasury Circular
in favour of the
six-inch scale.

Upon the understanding that the one-inch scale is to be continued and completed, I believe that for general purposes the six-inch scale is the most desirable, but that for towns and thickly populated districts, divided into many small holdings, a larger scale of map would be required; for this purpose the sixty-inch scale seems an excellent one.

I consider that for all *general* purposes, the six-inch scale is quite large enough, and that if a larger scale were adopted, the maps would become inconvenient and unwieldy from their size; on the other hand, for *special* purposes such a scale would be too small, and the larger scale being ten times that of the general map, would be probably quite large enough.

EDWARD SOLLY, Secretary.

No. 6.

MESSRS. STEWART AND KINCAID.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts as public records - -	
For plans to be engraved for sale - -	6 or 8
For draft plans of towns for record - -	
For plans of towns to be engraved for sale - -	60 or 80

SPECIAL OBSERVATIONS.

Leinster-street, Dublin, May 4, 1853.

We have read, and carefully considered, the correspondence and memoranda referred to, and forwarded with this letter.

As extensive land agents, and much engaged in making valuations of estates, and, therefore, very conversant with the use of the Ordnance maps of Ireland and other maps of estates on different scales, we are of opinion that the Ordnance survey of Ireland on a scale of six inches to the mile is eminently useful for all practical purposes, and, being less expensive and less cumbrous than one on a scale of twelve inches to the mile, is, in our opinion, more generally useful. We have consulted other land agents and land valuers in Dublin, and they concur with us in this opinion. We are not practical land surveyors ourselves; and on asking the opinion of one of our most experienced land surveyors, who has also had much practice and experience in making valuations of land for railway purposes, he has given us his opinion in writing, of which the following is a copy: he says, "I consider that an error was committed in having the Ordnance scale less than eight inches to the mile, which would admit of areas being calculated with more accuracy than the scale of six inches. The six-inch scale gives $53\frac{1}{2}$ perches to the inch; the eight-inch scale gives 40 perches or 10 chains to the inch—a scale hitherto very generally used by the best practical surveyors in this country; the one having a fractional part of an inch is complicated in use, the other simple and easy in application. The larger the scale by which a survey is laid down, the more accurate will be the result in ascertaining superficial areas. With this view, sixteen inches would be better than eight, and is the scale most generally used by practical surveyors where the land is valuable; but a National survey on this scale (of sixteen inches to the mile) would be very expensive and cumbrous; and, taking everything into account, I would recommend eight inches to the mile as the best for a National survey, with index maps, and of course larger maps of towns, as I think great accuracy can be combined with economy and general utility. Such is the opinion that 40 years' practice induces me to offer. I do not think that the twelve-inch scale would be much better than the six-inch, and would only tend to perplex and confound.—JOSEPH JAS. BYRNE, Lower Mount-street, Dublin."

We think that, whether the six-inch or eight-inch scale be adopted for the country parts, the survey of towns should be on a scale ten times the size.

We enclose two letters on this subject, one from Mr. Hamilton, a very extensive land agent, and brother to Mr. W. Tighe Hamilton, late Deputy Remembrancer in Ireland, and the other from Mr. Collis, who has been more

employed than any other person that we know in making surveys and valuations of estates for sale in the Incumbered Estates Court, both in favour of the six-inch scale.

Replies to the
Treasury Circular
in favour of the
six-inch scale.

MR. CHARLES E. HAMILTON TO MESSRS. STEWART AND KINCAID.

40, Dommick-street, April 28, 1853.

I think the six-inch map the most convenient that could possibly be made for general purposes, and that a larger scale would have no advantages to counterbalance its inconvenience.

MR. MAURICE COLLIS TO MESSRS. STEWART AND KINCAID.

3, North Great George-street, Dublin, May 3, 1853.

I have read your letter with attention, and have considered well the subject on which you express a wish to have my opinion.

From 1831 to 1838 I was practically engaged in the field in the Ordnance Survey of Ireland, working on the six-inch engraved maps and on maps reduced at the Ordnance Survey Office to a scale of one inch and two inches to a mile. From 1838 to 1849 I was chiefly engaged in the arrangement of the estates of Trinity College, some of the London companies, and other large landed proprietors, and in every case I worked in the field on the six-inch map, though I had the scale enlarged to twelve inches to the mile, and, in some cases, twenty-four inches.

In all the work I have done in the Incumbered Estates Court, the work on the ground has been carried out on the six-inch scale, though the maps are invariably enlarged to the scale of twelve inches. I have therefore no hesitation in coinciding in opinion with you as to the advantage and practical utility of the six-inch scale above any other.

The conflicting opinions you mention as existing in England and Scotland as to what scale it would be advisable to adopt for the national survey of the latter country are not, I am certain, held now; for if Ireland were to be surveyed over again, I am sure that few *practical* men would be found to advocate any scale but the six-inch.

Except in towns, I expect that the six-inch map is sufficiently large for any practical purpose; a larger scale would be an inconvenience, as it is of the greatest importance at times to grasp such an extent of country as an Ordnance sheet embraces, the scale enabling you, when in a favourable situation, to read the smallest fields for miles round; a larger or smaller scale could not do this with the same convenience.

No. 7.

COMMISSIONERS OF SUPPLY, BANFFSHIRE.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts as public records	-	6
For plans to be engraved for sale	-	-
For draft plans of towns for record	-	5 feet.
For plans of towns to be engraved for sale	-	-

HY. LUMSDEN, Convener of the County,
and Præsides of Meeting.

Replies to the
Treasury Circular
in favour of the
six-inch scale.

No. 8.

COMMISSIONERS OF SUPPLY, COUNTY OF ELGIN.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	-
For plans to be engraved for sale	-	-	-
For draft plans of towns for record	-	-	-
For plans of towns to be engraved for sale	-	-	-

SPECIAL OBSERVATIONS.

Excerpt from Minutes of the Annual Stated General Meeting of the Commissioners of Supply of the County of Elgin, held on 30th April 1853.

There were also submitted to the Meeting various documents from the Treasury Office, London, and also from Edinburgh, on the subject of the Ordnance Survey, which, having been referred to and discussed, the following resolution was unanimously agreed to, viz. : That in the opinion of this Meeting the six-inch scale is sufficient for every purpose required, and that a larger scale would be cumbersome, expensive, and difficult to refer to, and would not yield to the country commensurate advantages.

The Meeting were farther of opinion, that the one-inch scale will be quite large enough for publication.

Extracted from the Minutes by

PATRICK DUFF, Clerk of Supply.

No. 9.

COMMISSIONERS OF SUPPLY, STIRLINGSHIRE.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts as public records	-	-	-
For plans to be engraved for sale	-	-	6
For draft plans of towns for record	-	-	10 feet.
For plans of towns to be engraved for sale	-	-	5 feet.

SPECIAL OBSERVATIONS.

"The Meeting approved of the contouring, and earnestly begs that the survey may be executed as speedily as is consistent with accuracy, and that it may be carried on from the counties now completed to those contiguous northwards. The Meeting is of opinion that the scales above recommended are sufficiently large for general purposes, and are those that should be published."

Extracted from the Minutes of the Annual Meeting of Commissioners of Stirlingshire, held on the 30th April 1853, by

ROB. CAMPBELL, Clerk of Supply.

No. 10.

COMMISSIONERS OF SUPPLY, ROSS-SHIRE.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts as public records	-	-	6
For plans to be engraved for sale	-	-	-
For draft plans of towns for record	-	-	-
For plans of towns to be engraved for sale	-	-	-

KEITH STEWART MACKENZIE, Convener of Ross-shire.

No. 11.

COMMISSIONERS OF SUPPLY, CAITHNESS.

RECOMMENDED.

For draft plans of rural districts as public records	-	-	Inches to a mile.
For plans to be engraved for sale	-	-	not less than 6
For draft plans of towns for record	-	-	not less than 1
For plans of towns to be engraved for sale	-	-	not less than 60
			not less than 6

GEORGE D. MUIR, Convener.

Wick, April 30, 1853.

Replies to the
Treasury Circular
in favour of the
six-inch scale

No. 12.

MR. WILLIAM CHADWELL MYLNE.

RECOMMENDED.

For draft plans of rural districts as public records	-	-	Inches to a mile.
For plans to be engraved for sale	-	-	6
For draft plans of towns for record	-	-	5 feet.
For plans of towns to be engraved for sale	-	-	

SPECIAL OBSERVATIONS.

New River Head, London, May 9, 1853.

In answer to yours of the 22d of last month, I beg to state for the information of the Lords Commissioners of Her Majesty's Treasury that I consider the scale of six inches to the mile of sufficient magnitude for every object that can be required for the insertion of boundaries, &c. in country districts; and also that a scale of five feet to the mile in the majority of cases will be sufficient for the delineation of towns; yet there may be some few exceptions in the latter case as to towns, but such exceptions in my opinion must be very rare.

With regard to the question, whether the purposes which a National survey ought to subserve would be more fully provided by an enlarged scale, I cannot imagine that any corresponding advantage would be obtained (taking all circumstances into consideration) by enlarging the scale beyond that of five feet to the mile.

No. 13.

MR. CHARLES ROWCLIFFE.

RECOMMENDED.

For draft plans of rural districts, as public records	-	-	Inches to a mile.
For plans to be engraved for sale	-	-	6
For draft plans of towns for record	-	-	1
For plans of towns to be engraved for sale	-	-	5 feet.
			10 inches.

(Subject to the under-written remarks, most respectfully submitted.)

SPECIAL OBSERVATIONS.

Stogumber, near Taunton, May 7, 1853.

I do not consider that I have had sufficient opportunities of comparison of maps of one scale with maps of other scales, made for *national* purposes, or for the purposes of *large* districts, such as counties, and which contain matters really serviceable as public records, necessarily therefore minute, to some considerable extent, in their character, to entitle me to offer any opinion by way of recommendation, what particular scale should be adopted for plans for record. It would be easy to say six inches to a mile, or twelve; but I think not so easy to justify one beyond the other. The larger scale offers most opportunity for minute accuracy, if that be the object desired; whilst the smaller gives so much greater facility for comprehending a considerable district within one view.

One thing my long and considerable experience has taught me, that no public map can ever *correctly* show either the boundaries of counties, parishes, or proprietorships, by which latter word I mean properties. Such boundaries

Replies to the
Treasury Circular
in favour of the
six-inch scale.

are often identical; for instance, one gentleman owns to the extent of the boundary of parish A., and another to the extent of the adjoining parish B., and consequently the parish boundary is the proprietary or property boundary, which never can be satisfactorily ascertained *and fixed*, without reference to private title deeds and other sources of information, frequently unattainable without great pains and expense, and such as persons treating the matter as a public question only, could not be expected to, and, in fact, would not incur.

In determining the scale, therefore, the hope of fixing by any public plan and record such boundaries should, I humbly conceive, not be entertained; and if so, then I incline to the six-inch scale for the country, and five feet to the mile for *towns*, by which I mean not merely such towns as Taunton or Wiveliscombe, but Watchet, Williton, Dunster, Stogumber; indeed, all *large villages* and *small towns*, the distinction between which it is not easy to draw.

A twelve-inch scale may, I apprehend, well contain field boundaries; but those are now fast and continually changing, and the present existing tithe maps perhaps sufficiently show them.

No. 14.

MR. JAMES M. RENDEL.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	6
For plans to be engraved for sale	-	-	1
For draft plans of towns for record	-	-	-
For plans of towns to be engraved for sale	-	-	-

SPECIAL OBSERVATIONS.

Great George street, London, May 11, 1853.

I have named six inches to the mile "for the draft plans for rural districts to be preserved as public records, because such a scale, whilst it admits of easy reference, is sufficiently large for the accurate delineation of towns, villages, rivers, and their tributaries, canals, railways, public and private roads, which I regard as the only features of a country which such public maps can portray with any chance of usefulness that would justify the cost. It is also such a scale as admits of extreme accuracy in the delineation of hills so as to admit of *exact* reduction to the scale adopted for the published maps.

The scale of the plans to be engraved for sale should be one inch to a mile, and it is most important that those published to this scale should be hastened as much as possible.

As to the scales for the record and published maps of towns, it seems to me that it is expedient to vary the same, so as to adapt it to the size of the town and character of its streets, &c.

I would, however, remark, that my experience leads me to the opinion that when the scale is very large, the map being necessarily cut into small sections for convenience of reference ceases to be useful, also that the argument that great detail is wanted for some purposes, and that such cannot be shown but on a large scale, is not applicable to a record map, seeing that in almost all the important towns in the Kingdom such details are in a constant state of change.

No. 15.

SIR PHILIP EGERTON, BART., M.P.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	-
For plans to be engraved for sale	-	-	-
For draft plans of towns for record	-	-	-
For plans of towns to be engraved for sale	-	-	-

SPECIAL OBSERVATIONS.

Replies to the
Treasury Circular
in favour of the
six inch scale.

I am of opinion that the speedy publication of a complete map of the United Kingdom on the scale of one inch to the mile is of such pressing and paramount importance that it would be unwise to await the completion of the survey on any larger scale unless carried on at a far more rapid pace than has hitherto been the case for the reduction to the one-inch scale. If the two surveys cannot be carried on simultaneously, I would suspend the larger scale of operations until the smaller one was completed. The assumption that the reduced scale will, under any circumstances, be separately published is by no means satisfactory unless it be determined to do so at an early period.

No. 16.

THE LORD PROVOST OF EDINBURGH.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts as public records - -	-
For plans to be engraved for sale - - -	6
For draft plans of towns for record - - -	-
For plans of towns to be engraved for sale - -	60

Edinburgh, May 11, 1853.

I had the honour to receive your letter of 18th ult. requesting the opinion of the Magistrates and Council of this City in regard to the scales on which the maps of the Ordnance Survey are published.

And I have now to transmit the accompanying paper, containing the recommendations which the Magistrates and Council make, after the most mature consideration, and consulting persons practically conversant with such matters.

SPECIAL OBSERVATIONS.

The Town Council of Edinburgh recommend:—That every possible facility should be given to parties interested to get plans on a larger than the six-inch scale, plotted from the Government Survey at their own expense, when required by them.

That the term towns should include all royal and parliamentary burghs, and also all villages of any importance.

The Town Council think it of importance that the contour lines should be continued.

(Signed) D. McLAREN, Lord Provost.

No. 17.

SIR JAMES MATHESON, BART., M.P

RECOMMENDED.

	Inches to a mile
For draft plans of rural districts, as public records -	6
For plans to be engraved for sale - - -	-
For draft plans of towns for record - - -	-
For plans of towns to be engraved for sale -	-

SPECIAL OBSERVATIONS.

13, Cleveland-row, London, May 13, 1853.

The above is filled up and signed by the Convener for the County of Ross, as the opinion of the Statutory Meeting on 30th April, whom I deemed it advisable to consult.

I have now to add that I consider the one-inch scale most appropriate for the plans to be engraved for sale.

For the draft plans of towns I consider the enlarged scale suggested by the Hon. F. Charteris as the most suitable.

Replies to the
Treasury Circular
in favour of the
six-inch scale.

No. 18.

THE PRINCIPAL OF GLASGOW COLLEGE.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	6
For plans to be engraved for sale	-	1
For draft plans of towns for record	-	24
For plans of towns to be engraved for sale	-	12

The College, Glasgow, May 16, 1853.

Though feeling myself very imperfectly qualified to form or give an opinion as to the preferable scale on which the results of the Ordnance Survey of Scotland ought to be published, the question is one of such extreme public importance that I cannot refrain from complying with the request conveyed in your favour of the 18th April.

On perusing the various reports which have been put into my hands, I have come to the conclusions inserted in the Form furnished me, and which I take the liberty to return filled up.

SPECIAL OBSERVATIONS.

Maps of the rural districts of Scotland on a scale of not less than six inches to a mile, seem necessary for reference.

Though each of many barren and mountainous districts may appear as a mere blank on that scale, they require to be included in order to point out distinctly the relative position and limits of the more populous and better cultivated parts of a county.

On a large scale they would be too cumbrous for practical purposes, and, probably, too expensive, while they would be found too limited to embrace an accurate delineation of private properties. Such must, for the present, be left to the charge of their respective owners, or of those engaged in undertakings by which they may be affected.

The large scale is required for towns on many accounts, and especially as giving facility to measures for the improvement of their sanitary condition.

D. MACFARLAN, D.D.

No. 19.

HYDROGRAPHER TO THE ADMIRALTY.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	-
For plans to be engraved for sale	-	-
For draft plans of towns for records	-	-
For plans of towns to be engraved for sale	-	-

SPECIAL OBSERVATIONS.

Rear-Admiral Sir FRANCIS BEAUFORT, K.C.B. to the Right Hon. Sir
JAMES GRAHAM.

Hydrographic Office, Admiralty, May 12, 1853.

In reply to your letter transmitting Sir Charles Trevelyan's application to their Lordships, and calling for any observations of mine on the scale to be adopted for the Ordnance Survey of Great Britain, I beg that you will submit to their Lordships that to give a satisfactory statement of my opinions on this very complicated subject, would require a degree of time and leisure which I cannot command; and, indeed, it has already been so amply and ably discussed, that there seems to be little room for any addition to the mass of evidence that has been accumulated in the correspondence forwarded from the Treasury. Yet, as the question of the most expedient scale for the ultimate publication of this noble survey has long engrossed my attention, I may briefly say, that, for the great majority of purposes to which full and accurate maps of the Kingdom will be applied, I am persuaded that six inches to the statute mile will be found fully sufficient, for on this scale the 50th part of an inch (which in a well engraved map is a very manifest quantity), will represent a space of about six yards, and, therefore, will distinctly show the arrangement of every

group of houses, the turns and angles of almost any boundaries, the direction of all the main drains, and the tortuous courses of even the smallest streams.

I will also beg leave to state that, in my opinion, *contouring* lines round the hills are the only rational method of showing the real undulations of the ground; and they only can supply perfect data to subsequent map-makers, artists, and geologists, for the relief, the embellishment, and the distribution of the several objects to which their works are to apply. On the general fundamental *vadesire* there ought to be no shading, no random work, not a line nor a dot that does not tell the severe truth.

It would, I think, greatly increase the value of the maps, if on every sheet the latitude and longitude of some one spot were given, and if its two lateral boundaries were made truly converging meridians.

It might, moreover, be worth suggesting that if on each sheet two or three angles and distances of convenient objects were accurately given to seconds and to feet; it would furnish country surveyors with the means of filling up the intervals on a large scale, without fearing the hygrometric errors, which, in printing, no care nor art can avoid.

The general maps on the one inch scale will, I take it for granted, be continued in the same beautiful style that has distinguished all the latter publications of the Ordnance Map Office.

Replies to the
Treasury Circular
in favour of the
six-inch scale.

No. 20.

THE COMMISSIONERS OF SUPPLY, ZETLAND.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	- 6
For plans to be engraved for sale	-	-
For draft plans of towns for record	-	- 5 feet.
For plans of towns to be engraved for sale	-	-

W. K. DUNCAN, Clerk of Supply.

Lerwick, May 16, 1853.

No. 21.

TOWN COUNCIL OF PERTH.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	- 6
For plans to be engraved for sale	-	-
For draft plans of towns for record	-	- 60
For plans of towns to be engraved for sale	-	-

City Chambers, Perth, May 19, 1853.

In answer to your circular of the 21st ultimo, I now beg leave to hand you the recommendation of the Town Council of the City of Perth as to the scale of the map on the National Survey of Scotland.

JAMES DEWAR, Lord Provost.

No. 22.

PROFESSOR FORBES.

RECOMMENDED.

		Inches to a mile
For draft plans of rural districts, as public records	-	- (See below.)
For plans to be engraved for sale	-	-
For draft plans of towns for record	-	-
For plans of towns to be engraved for sale	-	-

Replies to the
Treasury Circular
in favour of the
six-inch scale.

SPECIAL OBSERVATIONS.

Edinburgh, May 20, 1855.

I am glad to see that the engraved one-inch map is regarded as a settled point.

My opinion is, that if the survey is made on the six-inch (still more if on any larger) scale, it ought not to be engraved on that scale except on special local application, backed by an offer to defray half or two-thirds of the expense.

The Duke of Wellington, in agreeing to the large scale, states (p. 18) that "A great part of the expense will be defrayed by local associations and individuals." Nothing can be more reasonable, but nothing of the kind has, I believe, taken place.

Until some rateable contribution is insisted on, it will be impossible to ascertain the real wants of the public in Scotland. The popular argument used in Scotland has been that what costs most must be best worth having, and that what Ireland has got, justice requires Scotland to have also.

I agree with Major Larcom (p. 28) that any survey beyond the six-inch should be made entirely at the expense of the parties applying for it. It seems to me quite unjust to tax the public to pay for surveys which evidently involve very valuable interests affecting only a small number of individuals. This applies equally to landed proprietors, to owners of mines, and to densely-populous towns.

All of these in my opinion should contribute largely to surveys on a scale of six inches or more.

There is one point which I wish to urge strongly.

Let the engraving of the one-inch map precede *exclusively* all other engraving, and be entirely finished for the public benefit before local enlargements for class interests are commenced.

I presume that there would be little difficulty in like manner in completing the drawings of the small scale map first.

I think it would be a very great hardship indeed if Scotland has not a one-inch map within ten years.

I see no objection, but the contrary, to combine with the usual effective shading of the one-inch scale, contour lines of 250, 500, 1,000, 1,500, feet. But this I do not press.

JAMES D. FORBES, Professor of Natural Philosophy.

No. 23.

MR. DAVID STEVENSON.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	-
For plans to be engraved for sale	-
For draft plans of towns for record	-
For plans of towns to be engraved for sale	-

SPECIAL OBSERVATIONS.

Edinburgh, May 25, 1853.

I have read the correspondence and memoranda, and I am of opinion that if the Ordnance Survey of Scotland were published on scales of one inch to the mile, and of six inches to the mile, every useful purpose, such as a national survey may be supposed to serve, would be attained. I do not think that anything short of the two plans on the scales mentioned would be sufficient.

No. 24.

THE DEPUTY CLERK REGISTRAR, N.B.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- 6 inches or above.
For plans to be engraved for sale	-
For draft plans of towns for records	- 5 feet or above.
For plans of towns to be engraved for sale	-

SPECIAL OBSERVATIONS.

H. M. General Register House, June 1, 1853.

The above recommendation is given solely with reference to registration purposes. I am of opinion that no map of a smaller scale than six inches to a mile in the case of rural districts, or five feet in towns, would be of even subsidiary use in their application to our system of registration in this country. I must, however, at the same time state, that the uses to which maps, constructed on any scale, however large, can be applied in the way of registration are extremely limited, without effecting a total change in our system of conveyancing. The only way in which I conceive maps on a scale sufficiently large can be made available, is that to a certain extent they may supersede private plans, which are frequently made, having reference to the descriptions in the dispositive clauses of charters, feu contracts, &c., thus forming a part of the arrangement between the parties. Even in this case, however, I believe there will be few instances in which parties will not feel it expedient to provide a private plan of their own. To construct maps which shall be sufficient to answer all the purposes of a public record, and then to supersede the necessity of registering the deeds themselves, I believe to be an impossibility.

W. P. DUNDAS, Deputy Clerk Registrar.

Replies to the
Treasury Circular
in favour of the
six inch scale.

No. 25.

COMMISSIONERS OF SUPPLY, COUNTY OF BUTE.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	-
For plans to be engraved for sale	-
For draft plans of towns for record	-
For plans of towns to be engraved for sale	-

SPECIAL OBSERVATIONS

At Rothesay, the 30th day of April 1853.

In a General Usual Meeting of the Commissioners of Supply of the County of Bute, whereof Robert Hunter, Esq., Advocate, Sheriff of the said County, was chosen Præses:

The Convener laid before the Meeting several communications he had received relative to the Government Trigonometrical Survey of Scotland, which being considered; the Meeting unanimously resolved that the Lords of Her Majesty's Treasury be respectfully urged to cause the execution of the survey to be made on the six-inch scale, and requested the Convener to communicate this resolution to their Lordships.

Excerpted from the minutes of the Meeting by

ARCHIBALD CAMPBELL,
Clerk of Supply of the County of Bute.

No. 26.

MR. G. B. GREENOUGH.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	-
For plans to be engraved for sale	-
For draft plans of towns for record	-
For plans of towns to be engraved for sale	-

SPECIAL OBSERVATIONS.

Regents Park, July 1853.

The scale of the Ordnance map should be regulated, I think, entirely by its objects, which should be *distinctly specified*. There is a broad distinction

Replies to the
Treasury Circular
in favour of the
six-inch scale.

between a survey and a map. Of the miscellaneous materials composing a national survey a very small portion could be inserted upon any map, and if all the materials which *could be* inserted were so, the result would be a mass of confusion. Every distinct subject requires a special map for its illustration, and the scale of such map should be proportioned to the probable amount of its contents. For most of the purposes required in a national survey the scale of six inches to the mile is preferable, in my opinion, to any other that can be employed. This is the smallest scale on which roads, rivers, &c., can be shown in true proportion, and the experience of the Commissioners of Encumbered Estates in Ireland shows that it is in most instances sufficient for their purposes. For the registration of deeds, the determination of tithes, for fiscal, sanitary, and parochial purposes, &c., it is confessedly too small, but these must be considered exceptional cases to be specially provided for. No *one* scale can suit all purposes, and if the six-inch were superseded on account of the purposes just specified, the substituted scale would obviously prove unsuitable to numerous and equally important purposes to which experience has shown that it is admirably adapted.

The improvements that have taken place of late years in the construction of maps, the various new processes introduced, and the numerous uses to which maps are now successfully applied, render it, I think, highly desirable that before starting anew all these circumstances should undergo attentive consideration. Every map should exhibit *unity of design*; no such unity is observable in the Ordnance map, and every change has necessarily occasioned great cost both of time and money. *Unity of time* is no less important. The map of an entire Kingdom ought, if it were possible, to be struck off at a beat. The preparation of the Ordnance map of England has already occupied sixty or seventy years, and it is still not completed.

The colouring of maps is another point which, as it should be conducted on *principle*, merits much consideration; the objects represented by lines may be heterogeneous to any extent, but one colour only can be applied to characterize one and the same idea.

No. 27.

SIR DENHAM NORREYS, BART, M.P.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	6
For plans to be engraved for sale	-	-
For draft plans of towns for records	-	11 feet or 132 inches.
For plans of towns to be engraved for sale	-	-

SPECIAL OBSERVATIONS.

Athenæum, July 21, 1853.

There is no reason why, in the first instance, 6 inches to 1 mile should have been preferred to any other scale. 8 inches to 1 mile would have been a better scale, inasmuch as taking the perch of $16\frac{1}{2}$ feet as *the unit*, $\frac{1}{40}$ of an inch (8 inches to 1 mile) is more easily read off than $\frac{1}{53.33}$ (6 inches to 1 mile); and the measuring scales, which will be in common use, are more likely to be correctly divided into 40 lines to 1 inch, than into $53\frac{1}{3}$ divisions. Still, as the entire of Ireland and a large portion of England and Scotland have been laid down on the scale of 6 inches, it ought not now to be deviated from. There is no national purpose (except registration) for which a six-inch map will be found insufficient, and even for private purposes it is quite large enough, provided that—

1st. The field boundaries be correctly laid down (which is not the case with our Irish maps, except those boundaries of fields which are also boundaries of townlands).

2d. That the engraving be done with the greatest precision and fineness of the lines; for the fineness or coarseness of a line, on such a scale, may involve a difference of several feet.

As dividing instruments are now used by all the superior instrument and scale makers, there is no difficulty in procuring a measuring scale accurately graduated to $\frac{1}{53.83}$ of an inch. Measurement on the map therefore can be made to a single perch. Why should the public be called on to pay for greater minuteness? I have lately had experience of the sufficiency of the six-inch map for a private purpose. In a partition suit, a small lot of land (either $2\frac{1}{2}$ or $3\frac{1}{2}$ acres, I forget which,) was to be allotted to me. I had the right to select the ground, and was not restricted as to its form. Its value to me depended on local circumstances, such as views, inclination of the ground, a portion of a river, and so forth. Its form was necessarily most irregular, yet I was able by the six-inch map to lay off the quantity to be assigned, and to combine all the considerations referred to, adding to one part, taking from another, yet still keeping to the proper quantity to be allotted to me.

Replies to the
Treasury Circular
in favour of the
six-inch scale.

As to the proposal to make the map on a large scale, and to reduce it to a six-inch scale for publication, it would be most objectionable, involving either that the map for publication should be reduced mechanically, or that a second series of maps should be laid down from the original field books, *i.e.* that there should be two original and authentic maps of appeal, one of which may differ from the other in some essential particular. Whereas by laying down the map on the scale of publication the transfer from the original to the copper plate is easily made and is little liable to error.

As to the registration maps, all that is required is the power of identification of each separate lot by a reference figure or letter. They do not require the same minute accuracy as other maps, and may be readily made from the six-inch map mechanically to any size required. To attempt complete accuracy would involve the necessity for maps of a much larger scale than that proposed. The man who has a freehold right to his cottage has as much right to claim a map large enough to have that cottage indexed as the great proprietor to have a map large enough to show every portion of his estate.

For geological purposes the six-inch map is TOO LARGE for publication. Hence in Ireland it is requisite for the Geological Survey to publish a map reduced to 1 inch to the mile. For engineering purposes the sufficiency of the six-inch map has been proved, as all the lines of railway in Ireland have been laid down upon it.

In any publication of the Survey, on whatever scale it may be, all the sheets, though containing nothing but a few altitudes, should be completed and published with great care and accuracy, as if they were maps of the greatest importance. A mineral vein discovered may lead to the formation of roads and towns in districts which are now mere wastes.

The index maps of the several counties should all be on the same scale, so that they might be easily connected together. The Irish index maps have not been so laid down. They vary in scale. This I consider to have been THE blunder of our Survey. In respect of altitudes, great care should be taken to give the lowest points between each separate station of the minor triangulations, and also altitudes sufficiently near the lowest altitude to show whether it be in a mere chasm or in a broad or narrow valley.

Town Maps.—As to the town scale of 5 feet to the inch, I consider it objectionable because, assuming the foot to be the unit which requires measurement for the correct ascertainment of property in towns, so small a scale as 60 inches to the mile does not admit of reading off to a foot. Whereas 11 feet or 132 inches to the mile would give 40 feet to the inch, and this is the smallest quantity or division which can be well read off. Nor is this inconsistent with my recommendation of the continuance of the six-inch scale, because it has been so much worked on already, for it is of no great importance that towns should be laid down on the same scale; the rural districts are continuous, towns are separate and distinct.

I have referred to figures of altitude alone, and not to contour lines. I prefer the former. Where there are many different kinds of boundary to be laid down (counties, baronies, parishes, townlands, [I know not what their equivalents would be called in Scotland] and every field boundary), contour lines *confuse the map*. If contour lines be desired, I recommend that they should be printed in colours, and that peculiar colours should be assigned to certain heights, supposed to be the limits of classes of vegetation, *or if* they vary too much, to definite heights. Suppose,

Replies to the
Treasury Circular
in favour of the
six inch scale.

Sepia	-	-	-	-	from 0 to 300
Yellow	-	-	-	-	„ 600
Green	-	-	-	-	„ 1,200
Blue	-	-	-	-	„ 2,000
Purple	-	-	-	-	„ 3,000
Red	-	-	-	-	

No. 28.

MR. A. HUNTER, WRITER TO THE SIGNET.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	6
For plans to be engraved for sale	- both 6 and 1
For draft plans of towns for record	- large 10 ft., and small 5 ft.
For plans of towns to be engraved for sale	- 5 feet

SPECIAL OBSERVATIONS.

Edinburgh, August 25, 1853.

I consider that it will be throwing away money to make more than skeleton maps of the vast extent of *moor* land in Scotland, merely showing rivers and rivulets, fences and general features of the country.

No. 29.

MR. J. F. BATEMAN.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- 6
For plans to be engraved for sale	- 6
For draft plans of towns for record	- 60
For plans of towns to be engraved for sale	- 60

Manchester, August 30, 1853.

I have perused with great interest the correspondence and memoranda which I have had the honour of receiving with reference to the question as to the most desirable scale for the publication of the Ordnance Survey, and I have given the subject, not only now, but on many previous occasions, much careful consideration.

I am of opinion that the six-inch scale maps as now published, with all the enclosures, streams, and buildings delineated, and contour lines of level at every twenty-five feet in height, are everything that can be desired. They contain all the particulars, and convey all the information which it is possible for a map to furnish on a scale quite large enough for general requirements, and for National purposes; and for the accurate laying out and delineation of projected engineering works. The scale will admit of great minuteness and accuracy of measurement and calculation; and I am of opinion that a larger one would be less useful, as each sheet would contain too small an extent of country to admit of comprehensive view or convenient reference.

Since the first publication of the Ordnance maps of the Northern counties of Ireland on the six-inch scale, and since the more recent publication of the English survey on the same scale, I have had occasion to refer to and employ the survey in both countries very extensively. The published Irish survey of the Northern counties does not contain all the enclosures, nor any contour lines of levels; but it is, nevertheless, a valuable map, and materially facilitates the operations of an engineer. But the English survey to an engineer is inestimable—an amount of information is at once laid before him,

which it would be impossible to obtain in any other way, and which enables him to lay out projected works, particularly canals and schemes for drainage, water supply, and town improvements with great rapidity, accuracy, and certainty. The only thing wanted is the completion of the geological portion of the survey.

Replies to the
Treasury Circular
in favour of the
six-inch scale

The scale is considerably larger than the limits prescribed for the general scale of Parliamentary surveys by the "Standing Orders" of the Houses of Parliament, but not quite so large as the scale required by Standing Orders for all buildings or gardens which may be effected by a proposed work. This, however, I consider a matter of little importance, as it would be less inconvenient to the public or to individual interests for Parliament to alter their Standing Order than for the whole survey of the country to be laid down or published on the larger scale.

With the Town survey on 60 inches to the mile I have also had considerable experience. I have largely used it for the laying down of water-pipes and sewers. I consider it to contain every necessary information for public purposes, and to admit of the accurate delineation of all works connected with the supply of water or gas, the construction of sewers, and street or sanitary improvements. A thick or shadow line on the front of all buildings, or on their southerly and easterly sides, would more clearly distinguish buildings from court-yards or enclosures, and it would be a further improvement if buildings could be marked by some light shade or tint which would not interfere with subsequent colouring.

The small maps on the one-inch scale, with the hills shaded, are very valuable for general purposes of reference for travelling, or for use in exploring a district with reference to lines of railway or other engineering works.

I see no reason for preserving draft maps of either rural districts or towns on scales larger or different to those on which they are published for sale. The published maps would be more likely to be accurate if copied from the draft on the same scale, than if reduced by pentagraph or other means from one scale to another; and the scales now adopted are, in my opinion, as I have already stated, large enough for all purposes of public record.

The geological portion of the survey would probably be most conveniently laid down on the one-inch scale. It would prevent the overcrowding or confusion of the maps on the larger scale, which ought to be specially adapted to the minute delineation of all surface features.

No. 30.

MR. GEORGE M'HAFFIE, PROVOST OF WIGTOWN.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	- 6
For plans to be engraved for sale	- -	- 1
For draft plans of towns for record	- -	- 60
For plans of towns to be engraved for sale	- -	- 60

SPECIAL OBSERVATIONS.

Wigtown, N.B., August 29, 1853.

In the moorland districts, where the inclosures are large, the six-inch scale is ample, while in the arable districts, and particularly near towns and villages, the small fields would not be usefully mapped on the six-inch scale; but as two scales could not practically be followed out without much additional trouble and expense, the six-inch scale under all the circumstances seems the best.

Replies to the
Treasury Circular
in favour of the
six inch scale.

No. 31.

MR. JOHN DICKSON.

RECOMMENDED.

	Inches to a mile
For draft plans of rural districts, as public records - - -	- 6
For plans to be engraved for sale - - -	- 6 and 1
For draft plans of towns for record - - -	- 5 feet
For plans of towns to be engraved for sale - - -	- 5 feet

SPECIAL OBSERVATIONS.

Laughton Mains, August 31, 1853.

I beg to return the above schedule, having read the correspondence with which you favoured me, and as I have frequently used the maps of Ireland on the six-inch scale in valuing estates in that country, I am of opinion that all the purposes of a National survey will be served by plans on the scale of six inches to the mile, coupled with a reduced plan of one inch to the mile.

No. 32.

MR. WILLIAM FAIRBAIRN.

Manchester, September 29, 1853.

AN absence of some weeks, and a press of business, have prevented me from giving that attention to the question of the national surveys to which it is so justly entitled. Ever since the Government undertook the survey of the United Kingdom I have advocated, for general purposes, the scale of six inches to a mile, and looking at the maps already published, both in Ireland and in this country, I am confirmed in the opinion that, for county maps, six inches to a mile is, in almost every respect, calculated to meet the requirements of the public service. It appears to me that a scale of six inches to a mile is in most respects superior to any other, as the size of the different divisions of a county are not too large, and that, being again reduced to one inch, renders the whole exceedingly convenient, either as regards reference to localities, or general consultation.

In geological inquiries for scientific objects, the investigation of mines and minerals, including engineering detail, twelve inches to the mile would be preferable; but the wants of the public will, in my opinion, be amply supplied by the smaller scale, as it appears to comprehend all that is wanted for general reference, and I am not quite sure how far it is expedient for the Government to do the whole of this service, excepting only as regards the general features of the country, and those characteristics of heights, distances, &c. which it is desirable every man should know.

To the survey of towns and densely populated districts it may, however, be desirable to introduce a larger scale, and that of sixty inches to the mile appears to be admirably adapted for the purpose. It is sufficiently large to mark out and trace the boundaries of property; and this survey, when executed with that degree of accuracy which has ever marked the labours of the Committee and the corps of Royal Engineers, we may reasonably look forward to the time when the demands of the public will be fully realised in the publication and dissemination of those invaluable documents.

It would have afforded me much pleasure to have brought this subject before the next meeting of the Literary and Philosophical Society of this city, but I fear the time allotted for the returns will have expired before the opinions of the members could be obtained.

REPLIES

IN FAVOUR OF

OTHER SCALES.

No. 1.

THE REGISTRAR-GENERAL

RECOMMENDED.

Replies to the
Treasury Circular
in favour of other
scales.

	Inches to a mile.
For draft plans of [cultivated] rural districts, as public records	24
For plans to be engraved for sale - - -	12
For draft plans of towns for record - - -	120
For plans of towns to be engraved for sale -	60

SPECIAL OBSERVATIONS.

General Register Office, April 25, 1853.

I am of opinion that in a National survey to be carried on at the public expense, the above scales will be eminently useful, as far as this department is concerned, in ascertaining the mortality of certain defined districts, in the collection of agricultural statistics, and in framing districts for enumerators in taking the census.

(Signed) GEORGE GRAHAM, Registrar-General.

No. 2.

THE PRESIDENT OF THE ROYAL GEOGRAPHICAL SOCIETY.

RECOMMENDED.

	Inches to a Mile.
For draft plans of rural districts, as public records - - -	24
For plans to be engraved for sale - - -	12
For draft plans of towns, for record - - -	-
For plans of towns to be engraved for sale - - -	-

SPECIAL OBSERVATIONS.

Belgrave Square, April 25, 1853.

In answer to your circular of the 20th April, I beg to state that, having formerly, and especially in my printed evidence before the Committee of the House of Commons (1851), fully expressed my views regarding the relative merits of maps of Scotland on the scales of six inches and one inch to the mile, I shall only briefly recur to that question in the few general observations with which this letter concludes.

In regard to the question of the adoption of the six-inch or a still larger scale, on which my opinion is asked, I recommend that the survey be made on a scale of twenty-four inches to the mile, that draft-plans on that scale be preserved as public records, and that the engraved plans for sale be on a scale of twelve inches to the mile, rather than on one of six inches, and for the following reasons:—

1st. The six-inch map is too large for a general map, and too small for an estate map.

Replies to the
Treasury Circular
in favour of other
scales.

2d. The six-inch map is too small to admit of accurate measurement of areas, especially of less than one acre, as is acknowledged by the advocates of that scale. (Correspondence, pp. 28, 29.)

3d. The six-inch maps have been found wholly inadequate for the purposes of the Tithe Commutation Act, the Parochial Assessments Act, and the Inclosure Act; so that additional surveys on a large scale have been found necessary for all these purposes. (Correspondence, p. 31.)

4th. The six-inch maps cannot be applied with safety and convenience for the registration of sales or transfer of land, assurances or encumbrances of property, or other similar purposes contemplated by Lord Langdale (Correspondence, p. 23), or for several of the purposes enumerated by Lieut.-Colonel Dawson. (Correspondence, p. 32.)

5th. That whilst the six-inch plans are too large for the general, geological, or mineral survey of the whole Kingdom, they are too small for the detailed plans of the richer mineral and coal districts, on which the course of mineral veins, the out-crop of coal-seams, beds of limestone and sandstone, and the distribution of other useful substances, would require to be laid down.

6th. From the statement of Colonel Dawson and other competent authorities it appears that a survey on the scale of twenty-four inches to the mile, with engraved plans, on a scale of twelve inches, is fully sufficient for these purposes, and likely to meet the wants of the nation for many years to come.

7th. That changes of boundaries, roads, new houses, and other alterations consequent on increase of population or improvement of the land, can be more readily entered on the plates if the larger scale be adopted.

For these and other reasons I recommend that, if the Government is to incur the great expense of surveying and engraving Scotland on a large scale, the twelve-inch plan be preferred to that of six-inch dimensions; the difference of expense* being more than compensated by the superior advantages of the larger scale.

In thus recommending a larger scale than six inches for the *plans*, I desire it may be understood that I have in no respect changed my opinions regarding the relative merits of the six-inch and one-inch *maps*, as expressed in my published evidence before the Committee of the House of Commons. The correspondence now printed, with the general demand for plans on a large scale, only more fully confirms and bears out the views there explained, of the comparative small value of the six-inch maps. I am still as firmly as ever of opinion, that a one-inch map is all that can be required for large portions of the Highlands and other wild and mountainous tracts of Scotland.

I must also express my strong fears that the time requisite for the production of a minutely-accurate survey on the large scale, and for drawing and engraving such vast outline plans, will occasion so much delay, that the present generation cannot expect to see the completion of the one-inch map of Scotland, at length promised by the Government and so long desiderated by geographers and the public.

I think, therefore, that the publication of a useful and accessible map of Scotland, available for all purposes of county or national improvement, should not be made dependent on the preparation of plans on the large scale. It was, indeed, my anxious hope that the beautiful system of mapping on the scale of one inch to the mile, which had been so very successfully applied by the Government Surveyors to North Wales, would have been extended without loss of time to the Highlands of the North.

It was this feeling, quickened by a sense of humiliation in the reflection that Scotland stood almost alone in Europe as a Kingdom without a map, which urged me to rouse public attention to the fact, first in 1834 and subsequently in 1850.†

The strong impressions I entertain on a subject I have so long considered must be my apology for requesting you to give publicity to my opinion.

(Signed) RODERICK IMPEY MURCHISON,
President Royal Geographical Society of London.

* The 6-inch plan costs 5*d.* per acre, the 12-inch costs 7*d.* per acre. (See Correspondence, p. 44.)

† See First Memorial Brit. Ass. Adv. of Science, 1834, printed by order of the House of Commons, 1835; and Memorial of the same body, 1850, which gave rise to the Parliamentary Committee of 1851.

No. 3.

MR. H. BELLENDEN KER.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	
For plans to be engraved for sale	-	6 inches.
For draft plans of towns for record	-	
For plans of towns to be engraved for sale	-	5 feet.

SPECIAL OBSERVATIONS.

Lincoln's Inn, April 24, 1853.

I think, for the reasons stated by the late Duke of Wellington, at page 17 of the accompanying correspondence, that the general scale should be six inches to the mile, and five feet to the mile for towns; but, in addition to these reasons, I think it should be borne in mind, that these maps must ultimately be used for fiscal purposes, and also for registry of deeds, and the transfer of lands; and, therefore, I would have the draft plans, both in rural districts and of towns, be on the largest convenient scale, so as to admit of their being used to show alterations of boundaries, and to test any inaccuracies in the reduced six-inch or five feet maps.

No. 4.

LORD BEAUMONT.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	26 $\frac{2}{3}$
For plans to be engraved for sale	-	12
For draft plans of towns for record	-	The larger the better.
For plans of towns to be engraved for sale	-	60 inches.

SPECIAL OBSERVATIONS.

A public map should be on a scale which would render it serviceable for as many purposes for which maps are required as possible.

26 $\frac{2}{3}$ inches to a mile in rural districts would be sufficient for poor-law and parochial arrangements, for valuations and management of private estates, for public sales and description of lots, for registration of assurances and transfer of property, for tithe-commutations and apportionment of rentcharge, for enclosures and awards, for copyhold courts and enfranchisements, for notices of railway bills and other improvement acts, for highway-trusts and courts of sewers, and all cases where land is assessed, rated, or dealt with.

I am not prepared to say that a map even on the above scale would suffice for all engineering, geological, sanitary, and military purposes, but in many cases even the engraved map, on a scale of twelve inches to the mile, would answer the object.

In cases where the engraved map did not suffice, parties should be enabled to obtain certified tracings of the draft plans.

No. 5.

MR. A. M. DUNLOP, M.P.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	26 $\frac{2}{3}$ or 24
For plans to be engraved for sale	-	18 $\frac{1}{3}$ or 12
For draft plans of towns for record	-	} 120
For plans of towns to be engraved for sale	-	

SPECIAL OBSERVATIONS.

I cannot entertain a doubt, after inspecting the maps on various scales, and considering the papers transmitted, that the six-inch scale is quite insufficient for many important purposes, and that a greatly larger scale should be adopted. Those of twenty-four inches for the draft plans, and twelve for publication,

Replies to the
Treasury Circular
in favour of other
scales.

seem to me sufficient in *actual size*, but the $26\frac{2}{3}$ and $13\frac{1}{3}$ scales have a great advantage in reference to the facility of calculating the extent of area by chains, which lead me to give a preference to these last.

In regard to the proposed *limits* of the survey for the enlarged scale, I doubt if it should be restricted to *cultivated* lands. One great advantage of the large scale is, that it provides for changes in consequence of the progress of the country, while if only the actually cultivated at the time of the survey were included, a great extent of *improvable* would have become *cultivated* some time before the whole survey was completed. It would, no doubt, occasion trouble and possible discontent, the fixing, at any party's discretion or judgment, what was improvable; but by taking a certain line of altitude, the same object would be *substantially* attained, and by a *definite* rule. The altitude would vary in different parts of the Kingdom; but it would be easy to take it so as to include all that was really improvable.

No. 6.

MR. E. ELLICE, JUN., M.P.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	-
For plans to be engraved for sale	-
For draft plans of towns for record	-
For plans of towns to be engraved for sale	-

SPECIAL OBSERVATIONS.

The object of *primary* importance is the publication of a correct map of Scotland, for the purposes of general and convenient reference.

A map upon the *one-inch* scale complies best with these conditions, and therefore whatever is determined upon regarding any other survey upon a larger scale, nothing, in my opinion, ought on any account to be allowed to interfere with the publication of the former upon the *one-inch* scale at the earliest possible period.

The special circumstances which led to the adoption of the six-inch scale in Ireland do not apply to Scotland, where a survey upon any larger scale than *one inch* would be of very partial advantage. But in cases where it might be useful, such as the mining districts, or where proprietors require good plans of their individual estates, the scale of twenty-six inches, or a scale as near as possible to that adopted generally by land surveyors, appears on all accounts to be the one most available for practical purposes.

A plan upon the *six-inch* scale seems to me to be comparatively useless.

I am not competent to express an opinion in regard to the *town* surveys.

No. 7.

COPYHOLD INCLOSURE AND TITHE COMMISSIONERS.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- $26\frac{2}{3}$
For plans to be engraved for sale	- $26\frac{2}{3}$
For draft plans of towns for record	- 120
For plans of towns to be engraved for sale—not prepared to give an opinion.	

SPECIAL OBSERVATIONS.

7, Whitehall Gardens, April 28, 1853.

We consider the $26\frac{2}{3}$ inch to a mile the scale which ought to be adopted for the draft plans of rural districts, because we find practically that this is the scale which has best answered the purpose where the correctness of internal quantities, &c. has to be tested, and because we believe that on any scale materially smaller this could not be done, and have had to reject maps on a smaller scale as useless for our purposes. It appears that a 24-inch scale might be desirable as a multiple of the 6-inch scale, yet as we have

Copyhold Inclosure and Tithe Commission.

Plan of
The Village of
E F F I N G H A M
SURREY.

Annexed to the Commissioners answers, in
relation to Scale of Ordnance Survey.



only actual experience in favour of $26\frac{2}{3}$, and as the surveyors are now accustomed to and familiar with the three chains to an inch, $26\frac{2}{3}$ inches to a mile, and an alteration would create confusion, we should prefer the $26\frac{2}{3}$ to a mile. If, however, on the account above mentioned, or on any other, there were strong reasons for the 24-inch to a mile, we are not prepared to say that the internal quantities might not be tested on it; but this is the smallest scale we should, in any event, hope to see adopted. As to the second question, we recommend the same scale to be adopted for the engraved plans for sale as for the draft plan, because, in our opinion, an engraved plan of any larger size than the Ordnance map, on which the internal quantities could not be measured, would be too large for the purposes of a general map, and too small for any other purpose; and we think there would be comparatively no sale for such plans; but believe, if the engraved were on the same scale as the draft plan, there would probably be a very extensive demand for them, because, as circumstances have of late much changed in consequence of the great alterations and improvements as well as drainage works which are going on in the agricultural districts, if an accurate plan could be purchased on which a competent surveyor could by measurement lay down those alterations and improvements as well as the drains, such plans would be purchased instead of fresh maps being made, as is often the case, or tracings being had of tithe maps when such existed, a great many of which are not first-class maps.

Replies to the
Treasury Circular
in favour of other
scales.

With respect to the scale for town plans, we, perhaps, ought not to offer a decided opinion; but having had to consider the scale which would answer in the case of altered apportionments, where the apportionment originally was in a rural district, and the re-apportionment has been required in consequence of the lands being sold for building purposes where a town is springing up, our attention has been called to the subject; and although, for these purposes, 2 chains to the inch, or 40 inches to the mile, is a scale sufficiently large, yet, in a national point of view, it has appeared to us that considering the great question of sewerage, and the different plans produced for the drainage of towns, such a scale could not be considered a national one; and we venture an opinion, with diffidence, that 10 feet to a mile would not be too large for these objects; but we do not feel competent to judge what scale ought to be adopted for engraved plans for sale of this description.

We have ventured to forward to you the accompanying map to be annexed to, and by way of illustration of the view taken by us and shown in, the answers to the questions submitted to us in reference to the scale on which the Ordnance maps should be made, and beg especially to call your attention to numbers 250, 251, 252, 296, 297, 297a, 240, 242, 243, on the scale $26\frac{2}{3}$ inches to a mile, and to the same allotments on the scale of 6 inches to one mile.

This comparison we trust will clearly demonstrate the uselessness of the latter scale for any plan made for purposes connected with this Office, and indeed for any purpose for which the internal quantities require to be set out, and tend to justify the opinions expressed by us.

(Signed) W. M. BLAMIRE,
G. DARBY,
H. C. MULES, } Commissioners.

MR. G. DARBY TO SIR CHARLES TREVELYAN, K.C.B.

7, Whitehall Gardens, April 28, 1853.

As Colonel Dawson is connected with this office, I have thought it best to state, for your own information, that our opinions, whether valueless, or of whatever value they may be, are our own, and entirely independent of any opinion of his, and we thought it more desirable that this should be so in consequence of his connexion with the office.

Replies to the
Treasury Circular
in favour of other
scales.

No. 8.

MR. G. S. DUFF, M.P.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- 24
For plans to be engraved for sale	- 12
For draft plans of towns for record	- 120
For plans of towns to be engraved for sale	- 60

SPECIAL OBSERVATIONS.

I look upon the record of plans as the matter of real importance to the country, and that it has been clearly proved that although the six-inch scale, adopted in the Irish Survey, was adapted for the special purposes then in view, a much larger scale is requisite for minute subdivisions. From the general tenor of the evidence sent to me I cannot doubt that the scales I have taken the liberty of recommending would be found practically available for all ordinary purposes either in their engraved or recorded shape. I consider that the question of scales before the Ordnance Survey (Scotland) Committee ought not to have been narrowed, as it was, to a consideration of the relative merits of the six and the one-inch scales, but should have been extended to the consideration of larger scales, on the advantage of which the Ordnance Survey Officers should have had an opportunity of expressing an opinion. I have only further to remark that I entirely concur in the recommendation of Lieut.-Colonel Dawson, R.E., "that pending the consideration of the question at least, if not for a continuance afterwards, the Ordnance Survey Department should be authorized to proceed with the degree of minuteness which should admit of the work being laid down on paper to the larger scale of twenty-four inches to a mile; so that whether that scale should eventually be determined on or not as a permanent arrangement, the landowners and others interested in any particular parish or district might be enabled at any time to obtain plans on the twenty-four-inch scale, on payment only of the additional expense of drawing the work upon paper."

No. 9.

MR. R. HALL, Land Agent and Valuer.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- 20
For plans to be engraved for sale	- 10
For draft plans of towns for record	- 80
For plans of towns to be engraved for sale	- 40

SPECIAL OBSERVATIONS.

Cirencester, April 30, 1853.

The scale of 20 inches is taken as being the smallest by which accuracy can be obtained in the computation of quantities, of 10 as being the most convenient for general purposes, of 80 as being sufficiently large for laying down and defining all descriptions of town property, and of 40 as being a very convenient size for reference.

No. 10.

MR. J. LANCASTER.

RECOMMENDED,

	Inches to a mile.
For draft plans of rural districts, as public records	- 24
For plans to be engraved for sale	- 6
For draft plans of towns for record	- 10 feet.
For plans of towns to be engraved for sale	- 5 feet.

SPECIAL OBSERVATIONS.

Shelton Colliery and Iron Works, April 30, 1853.

The scale recommended above is much larger than any hitherto attempted, but nothing in size beyond what appears to me necessary to ensure general usefulness, and above all accuracy in the matter of taking copies on various scales so frequently required for mining and minute divisions of property; I therefore think such a scale ought to be adopted by the Government, regardless of cost.

Replies to the
Treasury Circular
in favour of other
scales.

No. 11.

COMMISSIONERS OF SUPPLY, KIRKCUDBRIGHT.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	12
For plans to be engraved for sale	6
as well as the reduced scale of	1
For draft plans of towns for record	10 feet.
For plans of towns to be engraved for sale	5 feet.

SPECIAL OBSERVATIONS.

County Hall, Kirkcudbright, April 30, 1853.

It is most important to have the survey completed and published without unnecessary delay. Much disappointment has been experienced from the delay hitherto, and it is hoped that the increased size recommended will not still further increase this evil.

In regard to the sheets of the survey of this county which have been already published it may be stated that considerable inaccuracies occur in the orthography of and in the names of places.

(Signed) WELLWOOD MAXWELL,
Convener of the Commissioners of Supply
for the Stewartry of Kirkcudbright.

No. 12.

REV. R. JONES, SECRETARY TO THE CATHEDRAL COMMISSION.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	26 $\frac{2}{3}$
For plans to be engraved for sale	Same size.
For draft plans of towns for record	} I do not feel that I thoroughly understand this part of the subject.
For plans of towns to be engraved for sale	

SPECIAL OBSERVATIONS.

As a Tithe Commissioner I had too many opportunities of seeing that maps on a smaller scale were useless as public documents, because quantities could not be safely measured on them.

I found, too, that surveyors always constructed their maps on such a scale for their own purposes, and then locked them up to ensure being called on again for fresh work when land was subdivided.

If, therefore, the Ordnance maps are to be made really available for civil purposes by the landowners, they ought not to be on a less scale, and copies of them should clearly be so multiplied as to ensure this and future generations against the misfortune of losing such costly and useful documents.

No. 13.

COMMISSIONERS OF SUPPLY, ABERDEENSHIRE.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	24
or plans to be engraved for sale	-	6
For draft plans of towns for record	-	120
For plans of towns to be engraved for sale	-	60

(Signed) ROBERT GRANT,
Convenier of Aberdeenshire and Preses of County
Meeting, April 30, 1853.

No. 14.

MR. J. DUFF, M.P.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	24
For plans to be engraved for sale	-	12
For draft plans of towns for record	-	120
For plans of towns to be engraved for sale	-	60

SPECIAL OBSERVATIONS.

I look upon *the record* of plans as the matter of real importance to the country, and that it has been clearly proved that, although the six-inch scale adopted in the Irish survey was adapted for the special purposes then in view, a much larger scale is requisite for minute subdivisions. From the general tenor of the evidence sent to me, I cannot doubt that the scales I have taken the liberty of recommending would be found practically available for all ordinary purposes, either in their engraved or recorded shape. I consider that the question of scales before the Ordnance Survey (Scotland) Committee ought not to have been narrowed, as it was, to a consideration of the relative merits of the six and the one inch scales, but should have been extended to the consideration of larger scales, on the advantages of which the Ordnance Survey Officers should have had an opportunity of expressing an opinion. I have only further to remark, that I entirely concur in the recommendation of Lieut.-Colonel Dawson, R.E. "That pending the consideration of the question at least, if not for a continuance afterwards, the Ordnance Survey Department should be authorized to proceed with the degree of minuteness which should admit of the work being laid down on paper to the larger scale of twenty-four inches to a mile; so that, whether agreed on or not, as a permanent arrangement, the landowners or others interested in any particular parish or district might be enabled at any time to obtain plans on the 24-inch scale, on payment only of the additional expense of drawing the work upon paper.

No. 15.

MR. I. M. HERBERT, JUDGE OF COUNTY COURTS.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	24
For plans to be engraved for sale	-	12
For draft plans of towns for record	-	120
For plans of towns to be engraved for sale	-	60

SPECIAL OBSERVATIONS.

Rocklands, Herefordshire, May 3, 1853.

I feel great hesitation in expressing an opinion upon a subject with which I am so little conversant. It does, however, appear to me that a map on a smaller scale than that of twelve inches to the mile would be of little practical utility for civil purposes. The six-inch scale would be insufficient for local assessment, for the management of estates, or their transfer in connexion with a general register, for inclosures, for public or private drainage schemes, for

railway purposes, or for other public works of a like nature. Now the above are, *inter alia*, objects to which the Ordnance map, if constructed on an adequate scale, would be very generally applied; and, on this account, I venture to recommend the adoption of the 24-inch and 12-inch scales for its construction.

Replies to the
Treasury Circular
in favour of other
scales.

No. 16.

COMMISSIONERS OF SUPPLY, COUNTY OF LANARK.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns, for record	-	-	-
For plans of towns to be engraved for sale	-	-	-

Lanark, April 30, 1853.

Having laid the papers before the Meeting this day, I am desired to make the above recommendation for the cultivated districts of Scotland, (leaving the scale for the towns to be fixed by the parties more immediately interested,) and to request that the survey may be proceeded with in the most expeditious manner.

WILLIAM HAMILTON, Convener.

SPECIAL OBSERVATIONS.

To the Right Honourable the Lords of Her Majesty's Treasury.

The Memorial of the Commissioners of Supply of the County of Lanark, assembled at their Annual General Meeting held on 30th April 1853.

Humbly sheweth,

That the Memorialists had again under consideration at their Annual General Meeting held on the 30th day of April 1853, the subject of the Ordnance Survey of Scotland, and they regret being again obliged to bring before the notice of your Lordships the delay which has taken place in the prosecution of it; and it was unanimously resolved to urge your Lordships to give instructions to proceed with the survey with the least possible delay, and that upon a scale of 12 inches to the mile in place of a scale of 6 inches to the mile as formerly contemplated.

That in adopting the 12-inch scale, the Memorialists are humbly of opinion that it will render the maps more useful for many important purposes, and for others absolutely necessary, and in every respect preferable, in as far as while it will supply the purposes of an estate plan it will afford all the information requisite for the construction of any map required on a smaller scale. The Memorialists therefore approve of the proposal to make and publish a map on a scale of 12 inches to a mile, and resolved to intimate the approbation to your Lordships on the understanding that the original survey should be accessible to any party interested therein.

That in regard to the extraordinary procrastination of the survey and the apprehension thence arising as to the future progress of the work, the Memorialists do not consider it necessary to do more than bring it again under the notice of your Lordships, and they humbly trust that a sum will be appropriated which will be sufficient to insure a greater confidence to the public that the survey may be completed in the course of eight or ten years.

That the Memorialists would humbly urge upon your Lordships the inexpediency and injustice of the surveyors being sent from one part of the country to another at their own caprice or in obedience to instructions given in compliance with influential applications; and the Memorialists humbly submit, that irrespective of all influence, the survey ought to be proceeded with progressively and continuously over Scotland, according to the Report of the Committee which sat in 1851.

Signed in name and by appointment of the meeting,

WILLIAM HAMILTON, Convener.

Replies to the
Treasury Circular
in favour of other
scales.

No. 17.

COMMISSIONERS OF SUPPLY, COUNTY OF ARGYLL.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	13 $\frac{1}{8}$
For plans to be engraved for sale - - -	6 or 6 $\frac{2}{3}$
For draft plans of towns, for record - - -	-
For plans of towns, to be engraved for sale - - -	-

SPECIAL OBSERVATIONS.

It would be desirable that the regular order of survey from south to north, as originally intended, should be adhered to in publishing the maps, and that no counties may be allowed to receive a preference, and be surveyed out of their turn.

It appears also to the Meeting that the system of contouring may with advantage be abandoned as expensive, and tending to confusion in the maps.

Signed on the part of the Commissioners of Supply for the County of Argyll.

A. CAMPBELL, Chairman.

No. 18.

MR. J. T. DANSON, Barrister-at-Law.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	26 $\frac{2}{3}$
For plans to be engraved for sale - - -	13 $\frac{1}{8}$
For draft plans of towns, for record - - -	} See observation No. V., below.
For plans of towns to be engraved for sale - - -	

SPECIAL OBSERVATIONS.

- I. For the *rural scale* I prefer one of *more than six inches* to the mile.
 1. Because the six-inch scale, though sufficient for most practical purposes at present, is not sufficient for all.
 2. Because a larger scale will admit better of the corrections, alterations, and additions, incidental to the future use of such a map, even though the purposes for which it is required should remain the same as at present.
 3. Because the purposes for which such a map will be required are evidently still in progress of development; and it seems highly probable that the uses of the future will require greater minuteness and accuracy of division than those of the past and present.
 4. Because, with any reasonable expectation of the need for a large scale, it is wise to anticipate the need; "the additional first cost being by no means commensurate to the enlargement of the scale of a survey."
 5. Because the six-inch scale would not admit of a delineation of every boundary of property, and would call into exercise a discretionary power to omit some boundaries; and to secure a judicious exercise of such power would go far to make up the cost of a survey on a much larger scale, where no such discretion would be requisite.
 6. Because I conceive that such a map should be "a standard authority upon which to base the general improvement and development of the resources of the country;" and the scale most generally deemed requisite in practice for such purposes is, and always has been, much larger than that of six inches to the mile.
 7. Because a due increase of the scale would render such a national survey not only a valuable record of the state of the country, but also a check upon all local and particular surveys, as it would enable any person whose interests might be affected by measures connected with such surveys to ascertain their general accuracy quickly and cheaply.

II. For the *draft survey* of the *rural districts* I prefer a scale of $26\frac{1}{2}$ inches to the mile, because this tallies with the scale of superficial measure best known in this country, and most in use for all the purposes for (or in connexion with) which such a map would probably be required.

Replies to the
Treasury Circular
in favour of other
scales.

III. For the *maps to be engraved and published* of the *rural districts*, I prefer the scale of $13\frac{1}{2}$ inches to the mile, as being exactly half that of the survey, and therefore very easily compared with it; and also as being about the smallest scale upon which the more minute divisions of the soil could be indicated with a degree of accuracy sufficient for ordinary purposes.

IV. These opinions, I may as well add, rest (1) upon some years careful study of this and other related subjects; (2) upon a special investigation of the question, as it stood some six years ago, when I drew up the Report upon it published by the Law Amendment Society, and referred to by Mr. Charteris, pp. 23, 24 of the accompanying "correspondence," &c.; and (3) upon subsequent personal inquiry and observation in France, Belgium, Holland, Prussia, Austria, and Northern Italy.

V. As to the scales fittest for the survey and mapping of towns, I do not venture to offer any recommendation, not having so far considered the subject as to enable me to do so with any degree of confidence.

No. 19.

MESSRS. PICKERING AND SMITH, Estate Agents.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records -	- 20
For plans to be engraved for sale - - -	- 8
For draft plans of towns for record - - -	- 5 feet.
For plans of towns to be engraved for sale -	- 5 feet.

SPECIAL OBSERVATIONS.

14, Whitehall Place, May 2, 1853.

In accordance with your communication of the 22d ult., we have attentively read the papers and correspondence between the Treasury and the Ordnance, and various parties, as to the scales to be adopted for any national surveys.

We are of opinion that the scales most expedient for the public interests would be those recommended on the accompanying copy of circular, and signed by us.

No. 20.

SIR HENRY T. DE LA BECHE, C.B.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records -	- 24
For plans to be engraved for sale - - -	- 12
For draft plans of towns for record - - -	- 120
For plans of towns to be engraved for sale -	-
Index maps of towns - - -	- 12

This scale is adopted for the Ordnance index map of London.

SPECIAL OBSERVATIONS.

The map of one inch to a mile, a reduction of some map on a larger scale, having been determined upon, the amount of work to be inserted on each respectively, and the scale of the larger map, remain for consideration. It would appear desirable when there are two maps of a given area, one upon a considerable scale, as regards the other, that the smaller (a reduction of the larger map) should only contain those things which are required for general purposes, overcrowding of detail being avoided, and distinctness and importance given to objects which can be best understood by being massed or presented to the eye in a comprehensive form. Among the latter the effective

Replies to the
Treasury Circular
in favour of other
scales

representation of the physical relief of the country, with all the needful and varied modifications of ground, is important, and it will be greatly to be regretted if any system of drawing in the office, without inspection of the country, and having reference only to contour lines, be adopted which should supersede those portraits of country from actual drawing on the ground which are so successfully exhibited in many of the later Ordnance maps of England and Wales. However valuable contour lines may often be in some districts it would appear desirable to confine their insertion, if adopted, to the larger maps where they might be useful with other lines upon which relative levels may be marked. They might also be useful aids to the persons charged with the hill drawing on the ground. Merely joining such lines upon a one-inch map by hachures, usually thus representing an imaginary and commonly smooth fall, from one contour line to another, can never properly represent the physical relief of a country. For example, it would scarcely seem possible to represent the physical relief of North Wales by any such system of work unless the contour lines were so numerous as to be costly in the extreme, and even then some general drawing would seem needed. Nothing at all comparable with the engraved representation of the greater part of the hill drawing executed upon the Ordnance survey of that district could be produced, and it is known that in many instances the original drawings far exceeded the engravings in truthfulness and beauty. Upon such a service as the geological survey, on which the Ordnance maps are employed, the truthful representation of the ground is of the utmost importance, shortening labour by often materially aiding the geologist as to the directions in which he should expect the continuation of certain rocks, or the occurrence of others of a distinct character, and enabling him the more correctly to lay down his work upon the map. It is difficult to conceive how shading by hachures, between contour lines at their usual distance from each other, could represent many of those minor escarpments and details of ground which in several of our coal districts are so important for tracing the harder beds of rock associated with the coal beds, and which so aid the finding of the outcrops of the latter and those breaks in them known as *faults*. Yet these are among the easiest things for the hill draftsman on the ground to enter upon his work, and he would rarely omit them. It might readily happen that such minor lines of escarpment crossed several contour lines and yet be unrepresented by any hachures drawn from one contour line to another, perhaps some little deviation, at particular portions of the contour lines (should the minor escarpments be sufficiently steep) being the only indications of them.

With reference to the scale of the larger map, the evidence in the printed correspondence in favour of its being above six inches to the mile, appears conclusive, if this map is to be cadastral, available for such purposes as those mentioned by Lieut.-Colonel Dawson (correspondence p. 32) and by Mr. Vignoles (p. 42) or if it is to meet the view taken in the Treasury Minute of October 1, 1840, "that if a nation incurs the cost of a survey, that survey ought to be of the kind which is admitted to be the most generally useful." The scale of six inches to the mile has been found very serviceable upon the Geological Survey of Ireland, but one upon a larger scale would be still more advantageous for the mineral districts, as they are usually termed. It would be important there to have scales more approaching those employed in them for mining plans, which a survey on the scale of twenty-four inches to the mile and a published map on that of twelve inches to the mile would be.

With respect to the scale for town maps the experience of the Metropolitan Sewers Commission may be useful. When that Commission was first appointed, in lieu of the several district commissions under which the metropolis was placed, and it was found that there was almost a total absence of information as regards the positions and relative levels (independently of actual condition) of the mass of sewers which had been constructed during many centuries, while, at the same time, there was no surface map of sufficient accuracy on which to lay down any general system of drainage for the metropolis, it was determined that a block plan on a large scale, and based upon an effective triangulation, should be constructed. This important work was undertaken by the Ordnance, and the scale of five feet to the mile was adopted, that being the scale upon which the Ordnance Trigonometrical Survey had previously executed the plans of certain towns. An excellent block plan of the metro

polis was the result, and on this the lines of sewers, after careful survey as to their directions, levels, and general conditions, were inserted. Indeed, as respects this part of the work, the metropolis possesses information regarding its sewers not equalled, especially when the size of the area examined is considered, by any city in the world. Notwithstanding the general effectiveness of the scale for the object first sought, it was found too small when the house drainage had to be laid down upon it, even if the work was completed upon the block plan to the same extent as that entered upon the finished Ordnance maps of towns on the same scale. It was found advisable for the house drainage to survey the portions required on double that scale, namely on that of ten feet to the mile.

Replies to the
Treasury Circular
in favour of other
scales.

If to the drainage we add the various other purposes for which the plan or map of a town may be rendered available for the benefit of its inhabitants, either as respects municipal or private use, there appears still more reason for not confining the scale of such maps or plans to that of five feet to the mile. However effective that scale may be for some of the purposes required, it would be small for many others, and hence if, from experience, the scale of ten feet to the mile has been found sufficiently advantageous, as has been stated, the adoption of that scale for the record plans of towns would be desirable.

No. 21.

MESSRS. R. J. & H. CLUTTON, Estate Agents.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	20
For plans to be engraved for sale - - -	8
For draft plans of towns for record - - -	5 feet.
For plans of towns to be engraved for sale - - -	5 feet.

8, Whitehall Place, May 2, 1853.

In accordance with your communication of the 22d ultimo, we have attentively read the papers and correspondence between the Treasury and the Ordnance, and various parties as to the scales to be adopted for any national surveys.

We are of opinion that the scales most expedient for the public interest would be those recommended on the accompanying copy of circular, and signed by us.

No. 22.

SIR W. C. TREVELYAN, BART.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	24
For plans to be engraved for sale - - -	6
For draft plans of towns for record - - -	120
For plans of towns to be engraved for sale - - -	60

SPECIAL OBSERVATIONS.

The scale of six inches to the mile is, I think, for most practical purposes sufficiently large, and the draft plans made on a scale of 24 inches being "preserved as public records," copies from them can, of course, be obtained at any time by persons requiring plans on a larger scale than those published. For the reduced scale I should have preferred *two* inches to the mile, as more useful and not too large for common purposes.

The system of representing the inequalities of the surface and the elevation by contouring, instead of by shading or by vertical hatching, I think gives a better idea of the nature of the country (though the latter method makes a *prettier* map); contour lines have also, I presume, the additional recommendation of being less expensive to engrave, and they do not render other details indistinct or confused, as is often the case in maps which require much

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shading; and though the contour system may not be generally understood by the public, as it has been seldom seen by them, yet, I believe, were it generally adopted, its advantages would soon be appreciated.

In parts of the country, "desert and uninhabited," (as marked in a map of a northern county of England, published in the last century,) it would not be necessary, I presume, to give the details so minutely as in other districts, and the contour lines might be further apart, but the height of the principal summits should be shown; yet even in these parts it is not easy to say what the demands of future times and the progress of science may not ultimately require.

It might be a subject worthy of inquiry, in so extensive and so costly an undertaking, whether other methods of making copies of the maps for publication, might not be found as effective as, and less expensive than, engraving on copper; especially as in many parts of the survey it would be necessary, at intervals of a few years, to make many alterations or additions.

The general outline, and those natural features which are least likely to be changed, might be engraved on plates of steel or copper, and those details which are most liable to alteration might be drawn on zinc or stone, and printed within the first plate; these processes, however, would require the opinion of more practical men than myself, I merely think it right to throw out the hint for consideration.

No. 23.

MR. CHARLES BAILEY, Land Agent.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	26 $\frac{2}{3}$
For plans to be engraved for sale	-	-	13 $\frac{1}{3}$
For draft plans of towns for record	-	-	80
For plans of towns to be engraved for sale	-	-	40

SPECIAL OBSERVATIONS.

Stratford Place, London, May 2, 1853.

The scale of six inches to a mile was very properly adopted in the Irish Survey, for the purposes for which it was originally intended,—large enough to show accurately and legibly the boundaries of townlands; but it has failed to be of any satisfactory utility as a field survey, being too small to admit of any comparatively short lines being measured on the paper with anything like accuracy. I have had recourse to many hundreds of the sheets of various parts of Ireland, and whenever I have had occasion to deal with parts and parcels of townlands, I have found it necessary to direct new surveys to be made.

The importance of a national survey cannot be overrated; for independently of its utility in parochial assessment, inclosures, drainage and management of estates, sanitary purposes, railway and road plans, the sale and transfer of land and all dealings therewith, would be facilitated by reference to a correct plan, beyond all and every other suggestion made to or by the real property lawyers; for every practical conveyancer knows that the great expense and delay is generally occasioned by want of evidence of the identity of the parcels to be conveyed.

I am of opinion that the plottings should be made on a scale of three chains to an inch, or 26 $\frac{2}{3}$ inches to a mile, which is a proper scale for calculating the contents, and that such plottings should be kept as public records.

That for engraving and publication, the scale should be reduced one half (occupying one-fourth of the area of paper), namely, to a scale of six chains to an inch, or 13 $\frac{1}{3}$ inches to a mile. This would suffice for all ordinary purposes, and would not, I think, be considered too large or too small by experienced and scientific persons.

Nearly forty years full employment as a land agent and conveyancer enables me to submit the foregoing with much confidence, and I am much pleased to observe that my opinion on the subject, formed many years since, coincides

with Lieut.-Colonel Dawson, for whose judgment I have the most profound respect, and to whom the country is greatly indebted for the talent, zeal, and assiduity which he has displayed in his department of the Tithe Commutation Commission.

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scales.

There cannot be two opinions on the propriety of the continuation of the publication of the map of one inch to a mile, as commenced under the direction of the late Colonel Mudge. As a geographical map, and for all preliminary proceedings by engineers, it has proved extremely useful. Moreover, it could be made to answer the purposes of an index map to the plans to be published on the larger scales.

In the year 1836, I had the honour of submitting to Lord John Russell a plan for commuting the tithes, which was afterwards published by Ridgway & Co. as a pamphlet. At that time I was strongly impressed with an idea that as a first step in the commutation, the Ordnance surveyors should have made a field survey of the Kingdom. Such a survey would have rendered that great measure accurate and complete, instead of being, as it is, full of errors, arising from the use of "second-class maps," compiled by pretended surveyors from former inaccurate plans of estates, and which compilation was attended with more expense to the country than the complete Ordnance Survey would have involved. The "*first-class maps*" in the Tithe Office, which have been tested by Lieut.-Colonel Dawson, would, no doubt, be a saving of much time and expense in the formation of the contemplated Ordnance Field Survey.

The foregoing is respectfully submitted.

No. 24.

LORD ROSEBERY.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records -	24
For plans to be engraved for sale -	6, with contours.
For draft plans of towns for records -	10 feet.
For plans of towns to be engraved for sale -	5 feet.

Piccadilly, May 4, 1853.

I beg now to communicate the answer to your letter of the 22d April, which, I conclude, was addressed to me as Lord-Lieutenant of the County of Linlithgow.

As I did not feel competent individually to furnish the answers required, I referred your letter, and the printed papers accompanying it, to a General Meeting of the County on the 30th April, when the answers and remarks in the enclosed were unanimously approved of.

SPECIAL OBSERVATIONS.

The County of Linlithgow would also recommend that both cultivated and uncultivated lands should be laid down.

ROSEBERY, Lieut.

No. 25.

MR. J. K. BRUNEL, MR. ROBERT STEPHENSON, M.P.,
MR. JOSEPH LOCKE, M.P.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records -	20
For plans to be engraved for sale -	1
For draft plans of towns for record -	-
For plans of towns to be engraved for sale -	-

SPECIAL OBSERVATIONS.

London, 13, Duke Street, Westminster, May 3, 1853.

We beg to acknowledge the receipt of your letter of the 20th instant, and of a copy of the correspondence between the Lords Commissioners of Her

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scales.

Majesty's Treasury, the Board of Ordnance, and others, and soliciting our opinions as to what scale should be adopted for the future Ordnance Survey of Scotland and of the North of England.

Having conferred together on this subject, and having given evidence before the Parliamentary Committee in 1851, we have thought it better to combine our replies to your queries in a joint form, which we have now the pleasure of forwarding to you.

We are glad to observe that the publication of the one-inch map is to be continued; and we are of opinion that the publication of a map on that scale, already found to be so generally useful to the public, should be proceeded with and completed without the least delay.

For the purposes of giving more detailed information on engineering, parliamentary, special, military, naval, or local purposes, we are of opinion that a scale of six inches to a mile is not sufficient; and this view is supported by the following considerations—

1st. That engineers always (we believe) employ for all detailed purposes whatever, plans on a scale much larger than six inches to a mile.

2d. That Parliament, whilst it admits by its standing orders the deposit of maps on a scale of four inches to a mile, requires that all buildings, gardens, and enclosures within the curtilage of any buildings, shall be laid down on a scale of not less than thirteen inches to a mile; and this requirement is the result of recent legislation.

3d. That for ordinary Admiralty purposes it appears in evidence that the one-inch scale has been found more than sufficient, three-eighths of an inch having frequently been used; and that for all detailed purposes of showing harbours, estuaries, &c., scales from six to twelve inches have most generally been adopted.

4th and Lastly. That for all local purposes such as drainage, sewerage, tithe commutation, poor law assessments, and for the purposes of reference or general registration, scales varying from twelve to sixty inches to a mile have heretofore been employed in England; and if all the objects for which such maps are required, as well as those for the purposes of registration and reference are to be attained, we are of opinion that a six-inch scale is not sufficiently large or comprehensive; and that, looking forward to the further probable sub-division of property, and to the tendency which exists to simplify the transfer of property, a map on a scale of about twenty inches to a mile is that which we should recommend.

As regards engraving and publication we do not see any sufficient reason for the Government incurring any expense beyond that involved in the one-inch map.

A facility for making extracts from any such maps is what the public would require, but any further expense ought to be borne by the parties requiring the accommodation.

For the survey of towns, with very few exceptions, the scale of twenty inches to the mile would be quite large enough, but the publication of such towns should, we think, be borne by the parties requiring the same.

In reference to the remark made by Mr. Vignoles, "that the Cadastres of Bavaria, Wurtemberg, France, and some other States, are published at $\frac{1}{80,000}$ ($12\frac{2}{3}$ of an inch per mile), all of them reduced from the originals mapped on the double of that scale, viz., $\frac{1}{25,000}$," we feel it right to add that, as regards France, no such publication exists. We have made inquiries on the subject, and find that the only general published map of France (the état-major) is on the scale of $\frac{1}{80,000}$, which is about $\frac{8}{10}$ ths of an inch to a mile, although some of the departments have been published on the original plotting of double the scale, or $1\frac{6}{10}$ inches to a mile. This was done, however, at the expense of the department.

The towns in France of which maps have been engraved vary in their scales from $\frac{1}{10,000}$ to $\frac{1}{1,000}$ (6 inches to 63 inches to a mile), but their publication is always effected at the expense of the locality, and not by the State. We are not aware of any engraved or published map of that country on the scale of $\frac{1}{50,000}$.

Every delay in the publication of the one-inch map is an evil which is seriously felt by the public, and the efforts of the Ordnance Department ought to be, in our opinion, specially directed to the completion of that map.

No. 26.

MR. A. C. RAMSAY,

Local Director of the Geological Survey of Great Britain.

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scales.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	24
For plans to be engraved for sale - - -	12
For draft plans of towns for record -	} Have not sufficient experience to form any opinion of practical value on this point.
For plans of towns to be engraved for sale - - -	

SPECIAL OBSERVATIONS.

The following observations are founded on 12 years constant experience in geological surveying. They are made principally with reference to the bearings of the scales and other peculiarities of the Ordnance maps on the work of the Geological Survey of Great Britain, commenced under the Board of Ordnance, and lately transferred from the Office of Works, &c., to the Board of Trade.

1st. With reference to the above recommendation, permit me to state, that since 1845 having (as Local Director of the Geological Survey of Great Britain under Sir Henry De la Beche) had the charge of the field work of the Survey, I have invariably found that the publication of the geological maps on the one-inch scale has been attended with valuable results, a fact well attested by the great sale of the maps, especially of those connected with mining districts. Nevertheless I consider it certain that this scale is quite inadequate to the representation of detail whether in an economic or scientific point of view, such as the development of the mineral wealth of the country and the state of geological science require.

2d. Long practice has induced much skill in the expression of geological detail even on the one-inch scale, notwithstanding which the geologists of the Survey can by no means project on the maps the detail they ought to express, and the laudable attempt to do so, and even to introduce accurately such more obvious details as are practicable and essential, is the fertile cause of much loss of time and consequently of money to the country.

3d. On the authority of those of my colleagues who have at different times occupied the post of Local Director for Ireland, I may state, that the six-inch scale has been found large enough for the expression of all geological detail. That, however, is no good reason why the 12-inch scale should not be engraved for Scotland and the north of England, since it would be equally applicable for geological purposes with the six-inch scale, and at the same time serve many other civil purposes, some of them of equal importance to the country. The difference of expense is, in my opinion, scarce worth a thought. It would soon be far more than saved to the country by the numerous important uses to which the larger maps would be put. As one illustration of this I may add, that if the 12-inch map were extensively levelled or well contoured, it would occasionally save certain sums of money now spent by the Geological Survey in the construction of "Horizontal Sections" by means of the theodolite, with which instrument and the chain an approximate outline of the ground along a given line (sometimes from 50 to 90 miles in length) is obtained. One geologist and two chainmen are employed on each line, and it often takes several members of the Survey whole seasons from the operations of geological mappings to execute these lines, their pay and the men's wages being thus for a time absorbed in the completion of work which, with a contoured map on a large scale, would be executed much more rapidly and without the employment of so many men. The levelled and contoured maps of Ireland suffice for the purpose. Contours are better for the purpose than levelled lines.

4th. It has been stated in the correspondence that it would be impracticable to run contours with accuracy on clifty ground. Though not impossible, it would at all events be difficult and tedious to do so with accuracy. Nevertheless I consider contours of such inestimable value for purposes almost too obvious to require enumeration, that it is to be hoped the system may be carried out. Should contours be decided on for the great maps, in localities where difficulties occur that are well nigh insurmountable, it might still be

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useful approximately to mark the continuation of contours by dotted or interrupted lines. It is not in such localities that contours are usually most valuable, and therefore for short spaces approximations might suffice, till the ground becoming more easy to work upon an approach to absolute accuracy might again be attained and expressed. Even on such a country as that of Snowdon there is not very much ground on which it would be needful to employ interrupted lines. I speak from experience, having in the exercise of my official duties walked over almost every acre of the mountain, and traversed some of its roughest ground with the theodolite and chain. Were this style of engraving adopted it would obviate the necessity of leaving blank spaces on the maps where cliffy ground occurs, and those who refer to the maps would know that the interrupted lines indicate approximations only. In most cases such interruptions would be exceptional.

5th. While a large map is essential for amassing all needful information, a one-inch scale is also needed for generalizing the detail. The principal topographical details of hill shading of such maps should be executed with extreme accuracy, which I do not think it possible to attain by engravers etching the hachures from the information given by contours. By such a process I fear that its utility as a map would be impaired, and its truthfulness of expression and picturesque character destroyed. Should the engraver attempt to produce this character, never having seen the ground, he may unintentionally falsify its character.

The Welsh maps have been mentioned as models in style. Parts of them may almost be said to be so. The Cader Idris quarter sheet (59 N E) is a model of hill shading, and the character adopted to express the lakes is singularly simple and beautiful. You seem to look down from the hill sides into the clear water. It is generally well mapped; but the edges of some of the cliffs, when severely tested by the geological lines that run along and under them, were found to be a little out of place.

The north half of Pembrokeshire (sheet 40), executed, I believe, in great part by Mr. McLauchlan, is exceedingly accurate, and stood the test of the geological lines better than any other map in Wales. The Snowdon quarter (75 N.E.) is also for the most part well executed. The hill shading, and even the positions of some of the minor lakes, streams, &c., of 78 S.E. (the Bangor quarter), are sometimes so badly executed, that points on the geological lines being fixed by bearings on trigonometrical stations and other known points, they were frequently found to come in on places more or less removed from the ground as indicated by the hill shading, and the positions of surrounding objects. Extreme accuracy in the delineation of the ground is essential to the utility of such maps, and the accidental employment of ill-instructed or indifferent draftsmen a thing to be rigidly avoided.

6th. Respecting the extent of the ground to be surveyed on an enlarged scale, it seems to be the opinion of many that it should be applied to the manufacturing and cultivated districts alone. It should, however, be borne in mind that cultivated districts are not fixed areas; and further, that in all matters of a scientific class, that which may seem simply of scientific interest now, may in a few years in the course of discovery become of great practical and economic value. It is impossible to estimate to what uses geological or other scientific details may be turned even in areas that at first sight may appear most unpromising.

No. 27.

COMMISSIONERS OF SUPPLY, COUNTY OF FIFE.

	RECOMMENDED.	Inches to a mile.
For draft plans of rural districts, as public records	- -	26 $\frac{2}{3}$
For plans to be engraved for sale	- -	13 $\frac{1}{3}$
For draft plans of towns for record	- -	
For plans of towns to be engraved for sale	- -	

For the Commissioners of Supply of the County of Fife, in General Meeting assembled.

JAMES LINDSAY, Convener of Commissioners.

Cupar, April 30, 1853.

No. 28.

CHAIRMAN OF QUARTER SESSIONS, HADDINGTON.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	12
For plans to be engraved for sale	-	-	6
For draft plans of towns for record	-	-	5 feet.
For plans of towns to be engraved for sale	-	-	5 feet.

R. HUNSTORM, Chairman.

No. 29.

MR. E. W. WILMOT, Land Agent.

Hulme Walfield, Congleton, May 7, 1853.

I have, as requested in yours of the 27th April, perused carefully the correspondence sent. I am of opinion that—

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans engraved for sale	-	-	6
For draft plans of towns for record	-	-	60
For plans of towns to be engraved for sale	-	-	60

I have both in Ireland and Lancashire frequently used the six-inch maps, and find them sufficient for every purpose of valuation, drainage, fencing, &c.

The sixty-inch map of the City of Manchester and environs, I find amply large enough for every purpose, and use it frequently. A one-inch map for the rural districts would be also most useful.

No. 30.

LORD HATHERTON.

Thomas's Hotel, Berkeley Square, May 6, 1853.

On receiving your letter of the 22d April, accompanied by the paper respecting the scales for Ordnance maps, I thought I could not consult better for your object than by submitting them to the consideration of the individual whom I believed to be best qualified of all the surveyors in South Staffordshire by his judgment and experience to form a correct opinion on the question propounded by them.

I now enclose you his reply.

Mr. Taylor is a person who is about 40 years of age, and has been entrusted with most extensive surveys for estate maps, parochial maps, tithe commutation plans, railway surveys, and town improvement plans.

He is a person of remarkable accuracy, and universally acknowledged integrity. Lord Ward has just engaged his services for his Staffordshire estates.

Living in the centre of a great mineral district, his attention has been directed to the recent publication of the geological maps by Government. What he observes on that subject is worthy of attention.

The questions raised in your letter have long occupied my attention in consequence of my connexion with large properties in South Staffordshire. I believe the opinions of Mr. Taylor would be shared generally by the surveyors of his neighbourhood. They are exactly what I expected from him. But I was unwilling to give them as my own opinion, when I could state them on so much better authority.

MR. G. TAYLOR to LORD HATHERTON.

MY LORD,

The Deanery, Wolverhampton, May 4, 1853.

In reply to the inquiries contained in the circular from the Treasury Chambers, dated the 22d ultimo, in reference to which your Lordship has done me the honour of asking my opinion, I would beg to remark that a map of England on the same scale on which the Ordnance Map of Ireland has

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been published, viz., six inches to a mile, would be perfectly unavailable, and is also unnecessary, for the principal purposes for which Major Larcom, in page 27 of the correspondence, states it to have been so serviceable in Ireland, viz., the valuation for county and poor rates, reconstructing the poor law unions and electoral divisions, &c. The maps which have been prepared for the Poor Law Commissioners of England, in connexion with the valuations made for the same purpose form the basis of the county rates in England; and although these are not all correct, still they are far preferable for such purposes to a map on so small a scale as the Irish map.

There has been recently published by the Government a very valuable geological map of the South Staffordshire mining district, for which the Ordnance maps are taken as the basis, the scale being one mile to an inch; and on this map the whole of the faults, and the cropping out and dip of the various coal and ironstone measures are, I believe, accurately delineated so far as they are at present known, and the interest taken by the public of the district in this work is shown by the large number which have been sold, although it was not published till last December. I am told by the principal stationer in this town, that he has had a very great demand for them. For this purpose it would undoubtedly be a great advantage to have a map on a large scale, and I do not think that a more convenient scale than that of the Irish Ordnance maps could be adopted. I do not suppose it would be possible to find either an engineer or a surveyor of any experience in setting out railways in England, who would not speak in the highest terms of the English Ordnance maps on the scale of one inch to a mile; and on this subject I would beg to direct your Lordship's attention to the quotation from Messrs. Brunel, Stevenson, and Locke's evidence, at the top of page 20 in the correspondence.

The question upon what scale any other map should be made depends upon the purpose for which it is intended to use it.

If it is proposed to have such a map as may be used in carrying out a system for the registration of all title deeds of estates, it is certain that a map on the Irish scale would not suffice. I think this part of the case cannot be more clearly set forth than in Mr. Charteris's memorandum, in page 23 and 24 of the correspondence; and I think, as there appears every probability that some system for the registration of all transfers of real property will be devised in a short time, it would be very desirable that any additional maps which are made should be on such a scale as to render them available for this purpose. The same remark would apply to the cultivated districts of Scotland, and the question respecting the scale of that map is very clearly set forth by Mr. Charteris in page 20 of the correspondence.

I think I may say it is considered a settled point with surveyors that quantities of fields cannot be accurately computed from a map on a scale much smaller than three chains to an inch, equal to $26\frac{2}{3}$ inches to a mile; and as I do not see with what object a national survey can now be undertaken except in connexion with a system for the registration of all real property, this or some other scale nearly approximating to it, say twenty-four inches to a mile, would appear to me to be the most useful.

For the survey of towns, I do not think that a better scale could be adopted than that now in use under the Board of Health, viz., 44 feet to an inch, or 10 feet to a mile.

Unless maps are required for the purpose of a general registration of all real property, I do not see what necessity there is for a new national survey. Had it been undertaken for the purposes of the tithe commutation it would have been invaluable, as almost every parish in England and Wales would have had a copy of the same, so far as related to such parish, deposited therein with the apportionment of the tithes.

Maps of all these parishes have been made during the last fifteen years for the Tithe Commissioners or the Poor Law Commissioners, and such maps, under our present system, are sufficient for all purposes for which maps on a large scale are required, excepting the drainage of towns, and maps for this purpose either have been made, or are now being made under the directions of the Board of Health.

If the Government are to publish a map on a sufficiently large scale for the quantities to be computed therefrom, and which shall be received as evidence, very few of the existing maps would be of any assistance, except the map

prepared under the Board of Health and the tithe maps, which have been sealed as first class maps by the Tithe Commissioners.

It is clear this ought not to be so, but it has resulted from the system that was too generally adopted of appointing the surveyors who would work at the lowest rate, almost regardless of their standing in the business. I have no hesitation in saying that had the local surveyors of known respectability been employed, the results would have been very different.

I do not see what good would arise from publishing any map of the whole country on a large scale. It would be a great advantage that the result of the Government Geological Survey of the *Mining Districts* should be published on the same scale, or a scale approximating to that of the Irish Survey; and if landowners or other parties required a copy of any portion of the large map, they might obtain it in the same way as any one can now obtain copies of the maps deposited with the Tithe Commissioners for England and Wales, viz., by paying a moderate sum for the cost of making such copy.

My reply to the inquiries at the end of the circular would therefore be:—

To the first. That the plan should be on a scale of twenty-four inches to a mile.

To the second. I do not think it necessary to publish this map.

To the third. The same scale as the surveys made under the Board of Health, viz., ten feet to a mile.

To the fourth. On a scale of two feet to a mile.

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in favour of other
scales.

No. 31.

COMMISSIONERS OF SUPPLY, PERTHSHIRE.

Perth, April 30, 1853.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records,	-	12 instead of 6
Provided it is not attended with any material delay.		
For plans to be engraved for sale	- -	6 and 1
For draft plans of towns for record	- -	-
For plans of towns to be engraved for sale	- -	-

SPECIAL OBSERVATIONS.

The county would strongly express their anxiety to have the survey proceeded with, with the least possible delay; and, if necessary, they would suggest the propriety of employing additional staff.

KINNAIRD.

No. 32.

MR. GEORGE DUNDAS, M.P.

26, Pall Mall, May 7, 1853.

Referring to your letter of the 19th April, in which you desire me to state to the Lords Commissioners of Her Majesty's Treasury the scales I should recommend for any national surveys which may be henceforward carried on at the public expense, I beg to return you the form you then enclosed me, which has been filled up by the Convener and Commissioners of Supply of the County of Linlithgow, which I have the honour of representing.

In the views thus expressed I entirely concur.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	- -	24
For plans to be engraved for sale	- -	6 with contours.
For draft plans of towns for record	- -	10 feet.
For plans of towns to be engraved for sale	- -	5 feet.

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Treasury Circular
in favour of other
scales.

The county would advise that both cultivated and uncultivated lands should be laid down on the above scales, and that the survey should be proceeded with without delay, and that increased means should be voted for expediting the completion of it.

No. 33.

PROVOST OF DUNDEE.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	not less than 12
For plans to be engraved for sale	-	6
or draft plans of towns for record	-	264
For plans of towns to be engraved for sale	-	132

SPECIAL OBSERVATIONS.

There exists much diversity of opinion as to the best scale for the draft plans of rural districts for preservation. No doubt the larger the scale the better for reference; but a general feeling exists that for all practical purposes a scale of twelve inches would be well adapted, or rather, perhaps, six chains to the inch, or $13\frac{1}{3}$ inches to the mile.

There can be no question that the engraved plans would be of comparatively little value if a smaller scale than six inches were adopted, and most of the authorities, both scientific and practical, approve of the six-inch scale, as combining more advantages than any other that has yet been proposed.

With respect to towns it may be stated, that in the General Police and Improvement Act for Scotland, 13 & 14 Vict., cap. 33, it is enacted, that the Commissioners under it shall cause surveys and maps to be made of the burghs on a scale of not less than sixty inches to a mile. This scale is manifestly too small for sewerage, drainage, and sanitary purposes generally. A map of Dundee has been made on a scale of 50 feet to an inch, or 8 feet $9\frac{3}{4}$ inches to a mile. A map of Liverpool is now being constructed on a scale of 22 feet, 264 inches to a mile, and such a map will possess advantages beyond what one upon any smaller scale can hold out. If a scale of 11 feet or 132 inches were adopted for the plans of towns, to be published for the use of the inhabitants, it would give the boundaries of streets, lanes, town properties, and buildings with sufficient minuteness for all ordinary purposes.

P. H. THOMS, Provost and Chief Magistrate of the
Royal Burgh of Dundee.

No. 34.

MR. JONATHAN PIM.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	24
For plans to be engraved for sale	-	6
For draft plans of towns for record	-	120
For plans of towns to be engraved for sale	-	60

SPECIAL OBSERVATIONS.

Dublin, May 6, 1853.

The maps engraved on the scale of six inches to a mile seem to me more useful for general purposes than maps on a larger scale would probably be, but it appears particularly desirable that the original survey should be very exact, and that the manuscript draft plans should be laid down on a scale amply large enough to show the area of the maller divisions of property in

the populous districts, and to serve the various purposes connected with a national registration of landed property. It is of great importance to preserve a public record, accessible to persons properly authorized, which may not only meet the wants of the present time but those also which may be anticipated to arise from the progress of society.

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No. 35.

COMMISSIONERS OF SUPPLY, BERWICKSHIRE.

Dunse Castle, May 2, 1853.

I enclose an extract of the Minute of the County, held at Greenlaw on the 30th April.

WM. HAY, Convener of the County of Berwick.

Excerpt Minutes of General Meeting of Commissioners of Supply of the County of Berwick, held at Greenlaw, upon Saturday the 30th April 1853.

The Convener laid before the Meeting a communication from the Treasury requesting the opinion of the county on the question whether a larger scale than six inches to a mile should not be adopted in the maps of the unsurveyed portions of Scotland to be prepared by the Government Surveyors.

After considering this matter the Meeting were of opinion and accordingly recommended that the plans should be prepared and published upon the following scales :—

	Inches to a mile.
For draft plans of rural districts, as public records	- 24
For plans to be engraved for sale	- 6
For draft plans of towns for record	- 10 feet.
For plans of towns to be engraved for sale	- 5 feet.

The Meeting are of opinion that in the case of towns the larger plans ought not to be limited to those of a certain number of inhabitants, but ought to be extended to all towns.

Extracted from the Minutes by

G. PEAT, Clerk of Supply.

No. 36.

TRUSTEES OF THE HARBOUR OF DUNDEE.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records, not less than	- 12
For plans to be engraved for sale	- 6
For draft plans of towns for record	- 264
For plans of towns to be engraved for sale	- 132

SPECIAL OBSERVATIONS.

The larger the scale of the maps intended for preservation as public records the better ; and maps of the cultivated rural districts to be available for useful purposes should be published on a scale of not less than six inches to the mile.

With respect to the maps of navigable rivers, estuaries, and harbours, it is important that they should exhibit with distinctness the shallows, sand-banks, and soundings, and this cannot be done on a scale of less than six inches. The Trustees of the harbour of Dundee were subjected to great expense in getting an accurate survey and plan made of the river Tay for the purpose of showing not only the margin and course of the river but also the spaces taken in by adjacent proprietors and the effects of such operations.

Maps of the harbour and docks of such towns as Liverpool, Leith, and Dundee, should be laid down on the same scale as the towns themselves.

Signed in the name and by appointment of the Trustees of the harbour of Dundee,

Dundee, May 6, 1853.

P. H. JAMES, Chairman.

Replies to the
Treasury Circular
in favour of other
scales.

No. 37.

MR. JAMES HOPE, Deputy Keeper of the Signet..

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	24
For plans to be engraved for sale	-	12
For draft plans of towns for record	-	120
For plans of towns to be engraved for sale	-	5 feet.

SPECIAL OBSERVATIONS.

119, Princes Street, Edinburgh, May 6, 1853.

I beg to acknowledge receipt of your letter of the 18th ultimo, transmitting, by desire of the Lords Commissioners of the Treasury, a printed correspondence regarding the scale for the Ordnance survey in Scotland, and requesting my opinion thereon.

I have attentively perused the correspondence, and beg to state that, so far as I am able to form an opinion, the reasons stated by Lieut.-Colonel Dawson, in his letter to Mr. Charteris of date 4th April 1853, and by C. P. Smyth, Esq., in his letter to you of date 15th March 1853, in favour of a much larger scale than even six inches are most conclusive, and I shall not therefore add anything to what these gentlemen have so well expressed.

No. 38.

MESSRS. DANIEL SMITH AND SON, Estate Agents.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	
For plans to be engraved for sale	-	
For draft plans of towns for record	-	
For plans of towns to be engraved for sale	-	

SPECIAL OBSERVATIONS.

Waterloo Place, Pall Mall, May 6, 1853.

I have perused the printed correspondence, &c., on the relative advantages of various scales recommended for the Ordnance or national maps, and I intend my observations thereon to apply to England only, as they are founded solely on my experience as a land surveyor and agent, not presuming to offer an opinion on the more scientific and recondite objects for which these maps may be made available.

During a very long practice (and I was bred a surveyor step by step even from the first mechanical work of drawing the chain), in the course of which I have acted as a Commissioner of Inclosures, and have been otherwise extensively engaged in the management and valuation of estates in nearly every county in England and some parts of Wales, I have never found the Ordnance maps of any practical use beyond leading me to the spots and guiding me as to the courses and levels of rivers and canals, the direction of main roads and the relative position of towns to the property requiring my attention; and I am of opinion that a map of a less scale than three chains to the inch (or say at least 20 inches to the mile) could not be safely used by *landowners* when dealing with their estates either by way of sale or exchange, in subletting, or for drainage and many other local operations; indeed I have always looked upon general maps professing to show the boundaries of *private estates*, particularly if considered as to the *immense extra cost*, comparatively useless, and as rendering their more important points and features crowded and confused, and, from the constant changes in properties, grubbing of woodlands and fences, diversion of parish roads, &c., they must from time to time become incorrect.

As to Railways.

All the great trunk lines having been (though unfortunately very injudiciously and wastefully) formed, the application of such maps is no longer

required; as to *the drainage* of individual estates whenever undertaken, a local *and minute survey* as to the fields, brooks, and levels must be made, an inconsiderable *extra* expense which the landowners would readily incur.

Replies to the
Treasury Circular
in favour of other
scales.

As to parochial assessments and many fiscal objects, the tithe map now to be found in each parish (with few exceptions) will be, under some future inspection and revision (the cost of which would be fairly chargeable on the parishes where they have an imperfect or questionable map) more useful than any reference to a general map even if on an enlarged scale to that of the present Ordnance maps.

I should have suggested (though my opinion on this head may be considered out of place and time, if not obtrusive and uncalled for) that if the Ordnance maps were confined to the boundaries of counties, ecclesiastical dioceses, unions and parishes, market towns, and churches, and to the course of rivers, canals, railways, public roads, and bridges, with perhaps any extensive lakes and remarkable woods, without attempting to show particular fields or estates, they would be sufficiently useful for all national and statistical purposes upon a scale of 2 or 3 inches to a mile, but I should recommend that the maps should be *lineally divided into large squares or triangles*, such lines to be *most accurately measured*, and laid down to a scale of chains distinctly marked upon them, as I consider such lines would be of very great use when any particular local object is to be effected within such subdivisions as forming a fixed and safe basis for the interior survey.

It would be a very useful work if the various parochial and tithe commutation maps were re-examined and made perfect (for many are by no means to be relied upon), the Government retaining, independent of the one lodged at the tithe office, a fair copy of each as a reference on any points not embraced in the Ordnance maps.

These parish or union maps (unincumbered with other objects) *might* be sufficiently large (except perhaps in the manufacturing and mineral districts) upon a scale of 4 or 5 chains to the inch for all purposes.

The suggested squares or triangles on the Ordnance map might be lettered or numbered, and the parochial or union maps also, to correspond with them, so as to show at a glance what parochial maps are embraced within each lineal division when a reference is required for *local* objects.

CHARLES SMITH.

No. 39.

PRESIDENT OF THE GEOLOGICAL SOCIETY.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- 24
For plans to be engraved for sale	- 12
For draft plans of towns for record	} To these points I have not directed my attention sufficiently to war- rant my offering a definite opinion.
For plans of towns to be engraved for sale	

SPECIAL OBSERVATIONS.

I advocate the large scales named above for the plans of rural districts because I believe that in the end there will be gained a saving to the public and a benefit to the State, and that Government in adopting them will at the same time extensively and legitimately assist private interests.

Regarding the matter in a geological point of view, I believe that the distribution, spread, and boundaries of superficial and drift deposits (the knowledge of which is of great consequence for agricultural purposes) can be shown only upon plans of large scale, and that the scale mentioned would enable the geologist in many instances to aid the agriculturist in a manner quite unattainable with a one-inch map, and very insufficiently representable, as I have observed in Ireland, on one of the six-inch scale. The one-inch scale is, at the same time, invaluable for the delineation of rock-formations.

For the draft plans of rural districts I would adopt the same scale throughout, for though a tract of country may at present be barren and uncultivated, in the course of time and progress of science the worst land may be turned to good

Replies to the
Treasury Circular
in favour of other
scales.

account, in which case the obtaining of full-size plans whilst the survey is in operation will be by far the cheapest way of doing what sooner or later is sure to be required.

I would advocate very strongly the contouring of the ground, and do not admit the validity of any of the objections urged against contouring in the correspondence. A contoured map is a great boon to the man of science.

At the same time I would not dispense with the shading of hills which, however, in my opinion cannot be effectually executed unless sketched *on the ground* by competent persons, who, to do their work thoroughly, ought to possess a knowledge of geology. I would indicate as instances of hill delineation by a surveyor thoroughly prepared for his work, some of the charts of the Grecian Archipelago executed by Captain Spratt, R.N., the officer in charge of the Mediterranean survey and preserved in the Hydrographical Office of the Admiralty.

EDWARD FORBES, Pres. Geological Society, &c.

No. 40.

MR. THOS. S. WOOLLEY, Land Agent.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- 24
For plans to be engraved for sale	- 12 and 1
For draft plans of towns for record	- 120
For plans of towns to be engraved for sale	- 60

SPECIAL OBSERVATIONS.

South Collingham, near Newark.

I have carefully read through and considered the correspondence which I had the honour to receive from you.

That a scale of six inches to a mile is preferable for many purposes to that of one inch there can be no doubt.

I think, however, it is equally clear that for many very important purposes neither could be made available, and that the comparative cost of one on the scale I have ventured to recommend will be small in comparison with the advantage to be derived.

The want of public authorized maps on a scale sufficient to give the parcels of land and other details is already much felt, and I think if real property becomes chargeable with legacy duty the necessity for such maps will be still more strongly felt.

I have a very strong opinion, as a practical man, that it will not be advisable to incur the cost of maps on any scale which will not as far as possible answer all the purposes for which they will be required.

No. 41.

COMMISSIONERS OF SUPPLY, LINLITHGOWSHIRE.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- 24
For plans to be engraved for sale	- 6
For draft plans of towns for record	- 10 feet.
For plans for towns to be engraved for sale	- 5 feet.

Linlithgow, May 9, 1853.

I beg leave to transmit a memorial from the Commissioners of Supply of this county with regard to the Ordnance Survey, and also an extract from the Minutes of the General Meeting of the county, held upon the 30th ultimo. I have at same time to state, that the return referred to in the excerpt was transmitted to the county member, Mr. Dundas, with a request that he would attend to it.

ROBERT R. GLEN, Clerk of Supply.

Unto the Right Honourable the Lords Commissioners of Her Majesty's Treasury.

Replies to the
Treasury Circular
in favour of other
scales.

The Memorial of the Commissioners of Supply of the County of Linlithgow, assembled at the Half-yearly General Meeting, held at Linlithgow on 30th April 1853, humbly sheweth,—

That your memorialists consider that the early completion of the Ordnance Survey of Scotland is an object of the highest importance for promoting the development of the industrial resources of the country.

That it appears conclusively from the testimony of parties who have had experience of the advantages being derived in Ireland from the use of the Ordnance maps on the six-inch scale, that they have proved very useful in forwarding the surveys and superintendence of railways, roads, drainage, and other local improvements, and the valuation of property for public and parochial assessments, and afford valuable data for simplifying the identification and registration of properties, and for procuring accurate statistical information.

That, looking to the many important benefits which it is now proved will be derived from a National Survey on a large scale, it is much to be desired that the whole of Scotland should be surveyed and published in maps upon a scale of not less than six inches to the mile in counties; and when the large share of the public revenue which is being contributed by the people of Scotland is taken into view, your memorialists consider that they are reasonably entitled to expect that their position in regard to so important a work as the National Survey shall not be inferior to that of any other part of the Empire.

That as regards the peculiar claims of this county to a survey and map upon these scales, your memorialists would desire to bring under the notice of your Lordships,—

1. That it is almost all cultivated, and has a dense rural population.
2. That from its local position, lying betwixt the two seas, and betwixt the two chief cities of Scotland, Edinburgh and Glasgow, it abounds in roads, canals, and railways, which cannot be usefully and correctly delineated on a smaller scale.
3. That the county is rich in minerals, coal, ironstone, and limestone, which are now being used not only for local works within the county, but also for supplying the furnaces of Lanarkshire.

Therefore your memorialists humbly pray that your Lordships will be pleased to give instructions for the survey of the county of Linlithgow being made upon a scale of not less than six inches to the mile, with as little delay as possible, that maps be published upon both the six-inch and one-inch scales, and that your Lordships would take the necessary steps to procure increased grants from Parliament for those purposes.

And your memorialists will ever pray, &c.

Signed by the Convener of the Commissioners of Supply in name and by appointment of the Meeting.

NORMAN SHEIROF.

Excerpt from the Minutes of the Half-yearly General Meeting of the Commissioners of Supply of the County of Linlithgow, held upon 30th April 1853.

The Convener laid before the Meeting a circular letter from the Treasury, dated 18th April instant, requesting the Commissioners of Supply in the different counties in Scotland to state their opinion of the scales upon which the Ordnance Survey of the county should be taken down and published; and any special observations they might have to make on the subject. The Meeting considered that the landward part of the county should be laid down in the office books at twenty-four inches per mile, and engraved and published at six; and that towns should be laid down in the office books at ten feet per mile, and engraved and published at five. And they desired to observe that both cultivated and uncultivated lands should be laid down on the above scales, and that the survey should be proceeded with without delay; and that increased means should be voted for expediting the completion of it. The Convener accordingly subscribed a return to the foregoing effect; and the Clerk of Supply was directed to forward the same to the proper quarter.

ROBERT R. GLEN, Clerk of Supply.

Replies to the
Treasury Circular
in favour of other
scales.

No. 42.

MESSRS. DAVIS AND VIGERS, Land Agents.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

Frederick Street, Old Jewry.

In accordance with the request of the Lords Commissioners of Her Majesty's Treasury, conveyed to us in your letter of the 22d ult., we have read carefully and well considered the correspondence, &c., respecting the Ordnance maps, and we believe that the scales which we have inserted above would be most convenient to the public. You will perceive that we have adopted the scales recommended by Lieut.-Colonel Dawson, No. 6, page 33. We entirely agree with the reasoning of the Lieut.-Colonel, and beg to add that in our opinion a manuscript plan upon the large scale, if open to the public, would be a great national benefit, and that small charges for reference and tracings would be paid most cheerfully and very frequently.

We beg to apologize for having so long delayed our reply.

No. 43.

Mr. S. EDDY, Land Agent.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24 or $26\frac{2}{3}$
For plans to be engraved for sale	-	-	6
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

Grassington, near Skipton, May 9, 1853.

I consider the six-inch scale a most convenient size as a map of reference for all national purposes, but a still larger scale is required by parties engaged in conducting works of any kind where details and exact measurements are necessary, and for such purposes it is my opinion that the scales I have recommended for the record plans are such as would be found generally useful.

No. 44.

SOCIETY FOR PROMOTING THE AMENDMENT OF THE LAW.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	$26\frac{2}{3}$
For plans to be engraved for sale	-	-	$13\frac{1}{3}$
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

21, Regent Street.

The Society for promoting the Amendment of the Law having appointed a Committee in the year 1846 to consider the propriety of making a general map of the lands of England and Wales, for the purposes of registration and conveyance and otherwise, and to ascertain what steps have been taken and what materials are forthcoming for making such a map, adopted the Report of that Committee, which recommended the scale of $13\frac{1}{3}$ inches to a mile for rural districts, and 80 inches to a mile for towns.

The Council of the Society adhere to that opinion as regards the scale for

publication of the plans of rural districts, but, taking more fully into consideration the importance of minute accuracy for the purpose of registration of lands, the Society recommend for the draft plans of rural districts and towns respectively the adoption of the larger scales above mentioned.

Replies to the
Treasury Circular
in favour of other
scales.

JAMES STEWART, Treasurer,
ARTHUR SYMONDS, Hon. Sec.

No. 45.

MR. C. L. BRADLEY, Land Agent.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	26 $\frac{2}{3}$
For plans to be engraved for sale	-	-	13 $\frac{1}{3}$
For draft plans of towns for record	-	-	80
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

Richmond, Yorkshire, May 9, 1853.

Having carefully read the correspondence and memoranda relative to the Ordnance maps, I am of opinion that the six-inch scale is quite inadequate "for the draft plans of rural districts to be preserved as public records," and would recommend that the working plans should be on a scale of *three chains* to an inch or 26 $\frac{2}{3}$ inches to a mile, in order that the exact acreage may be obtained by admeasurement of each field or tenement upon the plan. Except in open moorland country the work might be laid down sufficiently accurate on a much smaller scale, say six chains to an inch or 13 $\frac{1}{3}$ inches to the mile.

"For the plans to be engraved for sale," the scale of six chains to the inch or 13 $\frac{1}{3}$ inches to the mile; this scale I consider the most useful for a township or estate plan, and generally adopted by surveyors.

"For the draft plans of towns for record" I would recommend a scale not less than one chain to an inch or eighty inches to the mile.

"For the plans of towns to be engraved for sale," a scale of five feet to the mile.

No. 46.

MR. S. VESSEY, Land Agent and Valuer.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	26 $\frac{2}{3}$
For plans to be engraved for sale	-	-	-
For draft plans of towns for record	-	-	-
For plans of towns to be engraved for sale	-	-	-

SPECIAL OBSERVATIONS.

Manor House, Halton, Spilsby, May 9, 1853.

In reply to your inquiries relative to the scale I would recommend as most desirable for any national survey which may henceforward be carried out at the public expense, it is my opinion that if the nation incur the cost of a survey that survey should be of a kind which is admitted to be most generally useful. Being rather extensively employed myself as a land valuer I feel no hesitation in saying that the scale of three chains to an inch is the best adapted for valuations, &c. The contents of fields on that scale can be computed from the map itself when compared with the book of reference, we then have a real security for its correctness.

My observations only apply to the agricultural districts, but if we take into consideration the inquiries which may be instituted relative to the value of landed property and the *minute calculations* which may be made in reference to the available resources of the United Kingdom, the land tax re-adjustment, the parochial, county, and poor rates assessment, the copyhold enfranchisement, and the probable imposition of duties on the succession to real estates, make it,

Replies to the
Treasury Circular
in favour of other
scales.

in my opinion, most desirable that the Government and the public should be in possession of accurate parochial plans on the scale to which I have alluded; the six-inch scale may do for engineering purposes, but is of no use to land valuers, being too large for a general map and too small to show the minute details and subdivisions. My suggestions, if carried out, would incur considerable expense, but I assure you it would be a popular measure throughout the country. I am concerned in the management of property in many parishes where the tithes have been commuted and where first-class plans (tested by the Tithe Commissioners) have been adopted. I have no trouble in those parishes. It facilitates the conveyance of real property, and combines *certainly*, *simplicity*, and *economy*, and will be a document that may be relied upon for ages to come. Several parishes (to avoid expense) were content to have the tithes apportioned upon old plans, in all cases they regret having done so. Parochial plans *must* be required ere long to be preserved as public records *for all purposes*.

The one-inch Ordnance maps are highly valuable and useful.

No. 47.

MR. JAMES JOHNSTONE, M.P. CLACKMANNANSHIRE.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	24
For plans to be engraved for sale	1
For draft plans of towns for record	-
For plans of towns to be engraved for sale	-

SPECIAL OBSERVATIONS.

After full consideration of the correspondence and memoranda, and more particularly the testimony of Lieut.-Colonel Dawson, R.E., No. 6, and the memorandum of the Hon. F. Charteris, No. 1, I have no doubt that for practical purposes the cultivated districts of Scotland should be surveyed on the twenty-four-inch scale whilst the mountainous districts need not be surveyed on so large a scale.

No. 48.

COMMISSIONERS OF SUPPLY, DUMFRIESSHIRE.

Dumfries, April 30, 1853.

In the General Annual Meeting of the Commissioners of Supply of the County of Dumfries, J. Macalpine Leny, Esq., in the Chair.

Mr. Leny brought under the notice of the Meeting the matter of the Ordnance Survey, communicating the substance of the correspondence between the Treasury and the Ordnance respecting the relative advantages of the six-inch scale and a still larger one. Sir William Jardine, after expressing at length his views on the subject, and exhibiting to the Meeting a set of maps on the six-inch and one-inch scales, moved that the printed schedule received from Mr. Charteris of the Treasury should be filled up as follows, viz. :—

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	26 $\frac{2}{3}$
For plans to be engraved for sale	6
For draft plans of towns for record	-
For plans of towns to be engraved for sale	-

SPECIAL OBSERVATIONS.

“The county of Dumfries, in filling up the schedule as above, rely on there being an engraved and published plan for sale on the scale of six inches to the mile.”

After some conversation, in which Mr. Stewart, Mr. Carruthers of Dormant, Mr. Maxwell of Glengaber, and others, took part, Sir William Jardine's motion was unanimously agreed to, and a strong representation was directed to be made to the Government to have the survey and maps completed as speedily as possible.

This communication to be made by the Convener to the Board of Ordnance, to the Honourable F. Charteris, one of the Lords of the Treasury, to Captain James of the Ordnance Office in Edinburgh, and to the members for the county and burghs of Dumfries.

Replies to the Treasury Circular in favour of other scales.

Extracted from the Minute Book by me,

ROBERT THRESHIE, Clerk of Supply

No. 49.

MR. A. E. LOCKHART, M.P. SELKIRKSHIRE.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

I would beg to suggest that the limit of population to which the survey of towns for sanitary purposes is supposed to extend, viz. 4,000, should be diminished to 3,000.

No. 50.

COMMISSIONERS OF SUPPLY, ROXBURGHSHIRE.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	{ Larger than 5 feet to the mile
For plans of towns to be engraved for sale	-	-	

SPECIAL OBSERVATIONS.

Excerpt from Minutes of Meeting of Committee of Commissioners of Supply, held at Jedburgh on 28th April 1853, regarding the Ordnance Survey.

The Convener laid before the Meeting a letter which he had received from the Honourable Mr. Charteris, along with certain papers regarding the Ordnance Survey in Scotland, requesting the opinion of the Commissioners of Supply whether the survey should be made on a six-inch or any larger scale.

The Committee having perused the said papers, and considered the subject, recommend that the Commissioners should approve of a survey on a scale of 24 inches to a mile for the draft plans of rural districts to be preserved as public records, and 12 inches for plans to be engraved for sale, and for draft plans of towns for records larger than 5 feet to the mile.

Certified by JOHN STEVENSON, Clerk of Supply.

Excerpt from Minute of Meeting of Commissioners of Supply held at Jedburgh, 30th April 1853.

The Meeting approve of the Report of the Committee as to the Ordnance Survey, and authorise the Preses to fill up the Return in terms of the said Report and forward the same as directed.

Certified by JOHN STEVENSON, Clerk of Supply.

Replies to the
Treasury Circular
in favour of other
scales.

No. 51.

METROPOLITAN COMMISSIONERS OF SEWERS.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	
For plans to be engraved for sale	-	-	
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	120

SPECIAL OBSERVATIONS.

1, Greek-street, Soho, May 12, 1853.

The experience of the Metropolitan Commissioners of Sewers being limited to the area under their active jurisdiction for sewerage purposes, they are not in a position to offer an opinion with respect to the best scales for rural districts. Their answer is therefore confined to the plans of towns.

A map of London and its vicinity, comprehending an area of about 114 square miles on a scale of 5 feet to a mile, was executed by the Ordnance Survey Department in the years 1848-9, and a part of it has been engraved on the same scale. For many purposes of this commission, the 5 feet scale has proved sufficient, but for others a larger scale has been required, and, accordingly, the Commissioners have caused several large portions of the districts under their superintendence to be re-surveyed and mapped on a 10 feet scale. Upon the whole, they are of opinion that a map, on this larger scale, of the entire metropolitan area, would prove highly useful, not only for sewerage but also for other purposes applicable to towns.

RICHARD JEBB,
Chairman of the Metropolitan Commis-
sioners of Sewers.

No. 52.

ECCLESIASTICAL COMMISSIONERS.

5, Whitehall Place, May 14, 1853.

Having attentively read the paper which accompanied your letter of the 20th ultimo, relating to a National Survey, and having also conferred with the Surveyors to this Board on the subject, I have the honour, in compliance with your request, to state that the scales which I would recommend as most expedient for the public interest are as follows:—

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	20
For plans to be engraved for sale	-	-	8
For draft plans of towns for record	-	-	60
For plans of towns to be engraved for sale	-	-	60

I should add that the above scales have special reference to the management of the estates, and to the sub-division of parishes.

JAMES J. CHALK, Secretary.

No. 53.

VISCOUNT EBRINGTON.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	24

SPECIAL OBSERVATIONS.

I rejoice to find that a reduced Ordnance map will certainly be published on the scale of one inch to the mile. This will be most useful for general purposes.

I trust that the boundaries of parishes and unions will be marked upon it ; a tolerably correct knowledge of them is required for many purposes. Not long ago, while I was at the Poor Law Board, I had occasion to inquire for a map showing those of parishes, and lament that there were hardly any maps at all showing them for any counties.

Replies to the Treasury Circular in favour of other scales.

Plans and maps of the uncultivated districts should not, in my opinion, be drawn on so large a scale as twenty-four inches, much less be published on a twelve-inch scale. I should be inclined to doubt the expediency of engraving and publishing any other maps of large wild districts besides the one-inch map for the present. The Ordnance would be the best judges, I should think, of the cases to which this different treatment ought to be applied, and of the scale on which, if this were adopted, they ought to be originally planned or mapped.

With regard to the town maps, I think the scales of 120 and 24 inches ought to be conceded to any place to which, by the wish of the inhabitants, the Public Health Act is applied; and that the expense should either be wholly defrayed out of the Parliamentary vote, on the ground of such maps forming part of the national work of the present Ordnance, instead of being, as I know they have been hitherto, estimated and charged at a much higher rate, though performed much less rapidly than the same maps would be by private individuals equally competent to the work. It would be a great work for the same towns to be twice mapped and planned.

I would express an earnest hope that the expense and time requisite for the completion of town maps will not be needlessly increased by details so perfectly useless as many appearing on the Dublin map; for instance, flower-beds and walks in the little gardens attached to the houses, &c.; and that instead of such absurd incumbrances, as many details as can be collected (without too much trouble and expense), as the course of water and gas-pipes and drains, their depths, &c., will be inserted. As to putting contour lines in general maps I will not venture to express any opinion, but I think them very convenient in town maps, and feel confident that they would be worth the small additional cost they would entail if placed so as to give a general idea of the lay of the ground, and not substituted for the indispensable bench marks and levels which I consider ought to be thickly marked on figures on the map.

No. 54.

MR. JOHN MEADOWS WHITE.

10, Whitehall Place, May 11, 1853.

1. Having read, and carefully considered, the correspondence and other papers with which you favoured me respecting the adoption of the six-inch scale for the Ordnance maps in 1840, and the relative advantages of that scale and a still larger one, I cannot doubt that the scale which ought to be adopted for a National cadastre, or Terrier map, is that of the largest scale which has been found practically useful, namely:—

	Inches to a mile.	
For draft plans of rural districts, as public records	-	26 $\frac{2}{3}$
For plans to be engraved for sale	-	26 $\frac{2}{3}$
For draft plans of towns for record	-	120
For plans of towns to be engraved for sale	-	120

2. If the question rested solely between a six-inch and a twelve-inch scale, as I see it was submitted to Mr. Vignoles and others, no doubt the twelve-inch should be chosen. If the adaptation of either a six or twelve inch scale to a larger be important, a 24-inch scale might answer the purpose; but as the larger scale of three chains to an inch, or 26 $\frac{2}{3}$ inches to a mile, is in practical use to a very large extent, a National map ought not, I think, to be on an inferior scale.

3. In offering these opinions, I beg to say that they have been formed after many years of experience in matters of parochial economy; and that in the course of my professional practice I have been engaged in conducting not less than 500 cases of tithe commutation in parishes extending over almost every part of England and Wales. I was also retained and employed by the Government in the preparation of the Poor Law Amendment Act, the Irish Poor

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Act, and the English Tithe Commutation Acts. For many years after the passing of the first of these Acts I was retained as Solicitor to the Poor Law Commissioners; and from the passing of the Tithe Commutation Act to the present day I have had the honour of being Solicitor to the Tithe and Inclosure Commissioners; and my practice as one of the Solicitors to the Ecclesiastical and Capitular Estate Commissioners has still further rendered the subject of maps and surveys, as well for public as for private purposes, familiar to me.

4. You are, no doubt, aware that, previous to the Tithe Commutation Act coming into operation, the six-chain scale was almost in universal use by the surveyors throughout the country; but it was soon found by the experience of the Tithe Commission that this scale was wholly inadequate for purposes of minute sub-division, where legal accuracy and the ascertaining of acreages or areas, were required, as in the case of tithe maps duly authenticated by the seal of the Commissioners, and so, unimpeachable under the 6 & 7 Will. 4. c. 72, s. 66.

5. The Tithe Commissioners, in 1837, pressed on the Government of the day the policy of a national map on a scale of adequate extent, as a measure of economy, and to be obtained at a less cost than the imperfect plans of isolated parishes. Unfortunately, the House of Commons, with a constitutional jealousy of furnishing too great facility for taxation to the Government, refused to sanction their recommendations, and the 1 Vict. cap. 69 was passed, enabling (by s. 1.) the Tithe Commissioners to dispense with sealed maps, which alone were left available for legal evidence. The result has been, that $\frac{5}{8}$ of the tithe maps are not only on too small a scale for ordinary practical purposes, but are perfectly useless for many of the public requirements of the present day. Indeed, any professional man will bear testimony to the fact that if one of these secondary maps be produced to verify the parcels or boundaries of an estate, as a part of the title, the fact of its not being a sealed map is at once notice that it is inaccurate, and not to be relied on for legal testimony; and when it is considered that the cost of these tithe maps, of which there must have been not less than 12,000, has probably approached to 2,000,000*l.*; and that not more than one-sixth are first-class maps, it is obvious that, to have a new survey on any but the largest scale would be an additional waste of public money, and loss to the community at large.

6. I observe that in Major Larcom's letter of 2d March 1853 he states, in reference to the six-inch scale, "I think the objectors to this scale are generally persons who use or require the maps but for one purpose, for which some find them too large, some too small; and, on the other hand, its advocates claim too much for it, by supposing, what is impossible, that it renders all other scales unnecessary; while there are very few people who have applied them to various purposes. The truth is, and it is idle to shut our eyes to it, no one scale can subserve all purposes; but I believe the six-inch serves, more than any other, as a convenient medium."

"For very general purposes, as geological maps, travelling maps, &c., they must be reduced to one inch, and combined. For such purposes as local registry they form only the index; and the 'parcels' must be exhibited by subsidiary enlargements, so also in valuations they answer for country lots, which form the great mass; but the towns must be enlarged."

7. On this point, I beg to observe that the question is not the adoption for a National Survey of a medium scale, which obviously cannot apply to any case requiring a scale of larger description than the proposed medium, but of a scale which can meet and cover every requirement. Colonel Dawson, in his communication, page 32 of "Correspondence," enumerates 12 of the greatest importance. Mr. Vignoles, at page 42, enumerates 18. A scale of three chains to an inch, or $26\frac{2}{3}$ inches to a mile, includes all these, and seems sufficient to subserve every other purpose that can be required for public or private service.

8. One practical point has often come under my notice where a map of the largest scale is essential. I allude to the subdivision of lands for building purposes. By the Tithe Commutation Act a rentcharge is fixed on a certain plot of land. The whole of this plot is liable to the whole rentcharge, and, unless certain steps be taken to alter the apportionment, every subdivision of it, however minute, is liable to the incumbrance of the entire rentcharge; but supposing it is wished to subdivide the rentcharge so far as to assign a portion of it to

each subdivision of the plot, a corresponding section of the apportionment plan has to be made and annexed to the instrument of subdivision. In every one of these cases, in the towns especially, a map of the largest scale is necessary. Such a one must be made at a heavy expense in each case where land is thus disposed of in small lots; with an enlarged map, applying to the whole parish, a mere tracing is enough to enable the landowners to vary the apportionment. This is a point affecting a large number of places, and one worthy of the consideration of Government in any provisions they may make for a new survey.

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9. As an illustration of this, I may mention that in the apportionment of Camberwell not less than 2,300 tenements were made subject to rentcharge. Of these more than 500 were tenements subject to rentcharges under 2s. 6d. per annum. These were subsequently reduced to a great extent under a subsequent Act; but after an apportionment is once made, there is no tenement, however small, which may not be subject to sub-division of the minutest kind, where a full-sized scale of map would be of infinite service. And in my own experience and practice I have to do with many such, and with one at this time, where there are more than 100 tenements with rentcharges under 1s. per annum, many of them as low as 1d.

10. So in the case of boundaries of parishes. I am at this time engaged in a question in my own parish, but merely as an inhabitant, and not professionally. We have a brook or river crossing the road where a bridge is necessary. The boundaries of two other parishes unite at the point of the crossing of this stream. On production of the tithe map on a six-chain scale, the boundary line wholly covers the point in dispute, and being only a secondary map, it is useless, though its preparation cost the parish a large sum.

11. But I forbear to multiply instances of which I could produce many. It is in fact a national question, and not one of detail. In this point of view, judging from the printed papers, I cannot see that there is any doubt which is the best scale. And if the nation do not secure the best, it is, as I have observed, a wanton waste of the public money to spend it on a map of an inferior scale.

12. Nevertheless I cannot but admit the paramount importance of restraining every question of this kind by limits of economy. This is only to be secured by having the best map, which will cover all the demands for public purposes—the best class of men in efficient numbers for making the maps—the greatest care in securing the repayment of the expense incurred—and, looking at the peculiar functions and duty of the Treasury, the readiest mode of meeting the expense without adding to the burthens of the country, beyond what is absolutely necessary and inevitable. These are points which I think may be met practically.

13. With this view I assume that adequate power would be obtained from Parliament to effect the desired object, and as it is plain that the whole country ought, as soon as possible, to have the benefit of the proposed survey, the power to retain, educate, and employ persons in this service should only be limited by its exigency, combined with the obvious necessity for its being superintended by the best officers that can be secured. Their power of obtaining the required accuracy would be itself a sufficient limit on the engagement of their subordinate staff of officers and men.

14. As to the necessary funds, I would suggest that they might be obtained by a loan from the Chancery Suitors' Fund, on the security of Exchequer 2l. 10s. per cent. Bonds. This fund, which amounts to many millions, arises partly from unclaimed dividends, and partly from trust funds in the Court of Chancery, where so large a mass of landed and house property is held in trust and administered. It is, therefore, a legitimate application of that fund to make advances for such a purpose as this on these public securities. The mode and periods of borrowing and repayment would, of course, be regulated according to the exigency of the service, and the provisions made by Parliament for the purpose.

15. The repayment to the Treasury might be met by enacting that as soon as any county or district be completed on the proposed scale, each union, covered by the survey, should be required to take a copy at a price commensurate to the outlay, including a proportion of the cost of the department itself. The amount thus assessed might be levied by an acreable rate, similar to that now levied for union purposes, either payable in one sum, or by periodical instalments, as for an emigration fund, or for drainage and other local public purposes.

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16. Provision could also be made for replacing the money thus charged on the union, by enabling owners of property to take copies and tracings at a given price, to be appropriated towards the liquidation of the debt. And the privilege of selling printed copies to the public at some small advance on the cost price, might be available either in reduction of the original outlay by the Government, or union, or parish, as might be found most convenient.

17. But as the necessity for such a map is wholly based on its being a public benefit, those to whom its proximate advantages are greatest ought not to acquire them wholly, without being called upon to protect the repayment of the necessary outlay. Hence, I do not see why, if (as I cannot but believe must be the case) a map be necessary for carrying out efficiently any measure for the registration of assurances, it should not be provided that after a union has been supplied with the new survey, no map should be receivable with any assurances save a transcript from the official map, duly authenticated. And all office copies of maps, required for evidence in any case, should be supplied from the same source.

18. All these points are, however, little short of the importance of fixing the scale itself; and probably before any enactment were made, the issuing of a commission to review the whole subject, take evidence and report to Parliament, would be the most prudent and practical course. But I must repeat, in conclusion, that to adopt a scale short of what will cover every requirement, public and private, will be a complete waste of public money, and a delusion on the public, who look for, and are entitled to, the best map, if they are to have any.

No. 55.

MR. CHARLES NEALE, Land Agent and Valuer.

RECOMMENDED.			Inches to a mile.
For draft plans of rural districts, as public records	-	-	26 $\frac{2}{3}$
For plans to be engraved for sale	-	-	18 $\frac{1}{3}$
For draft plans of towns for record	-	-	80
For plans of towns to be engraved for sale	-	-	40

SPECIAL OBSERVATIONS.

Mansfield Woodhouse, May 17, 1853.

It entirely depends upon the purposes to which plans are intended to be applied, whether they should be drawn upon a large or small scale. The scales I have recommended above are, in my opinion, those which would be most generally useful and applicable to the requirements of the country for most civil purposes, particularly for the sale and transfer of property and the management of estates, parochial assessments, and inclosures, also for drainage and sanitary purposes; and as they are the scales adopted for the most part in the recent Tithe Commutation Surveys, the preparation of the plans would be less difficult and expensive than any other; and if the subdivision fences are to be shown, and the different properties distinguished, any smaller scale could not be depended upon.

I would still have the maps published on the small scale of one inch to the mile, leaving out the subdivision fences, and retaining the roads, rivers, boundaries of parishes, unions, &c., as these would be much more convenient than the larger plans for reference, and they might be made to serve as indices to the larger plans by corresponding numbers or letters.

No. 56.

MR. THOMAS SOPWITH.

RECOMMENDED.			Inches to a mile.
For draft plans of rural districts, as public records	-	-	} See special observations.
For plans to be engraved for sale	-	-	
For draft plans of towns for record	-	-	
For plans of towns to be engraved for sale	-	-	

SPECIAL OBSERVATIONS.

Allenheads, Newcastle-on-Tyne, May 19, 1853.

I beg respectfully to state that the delay in my replying to the printed circular and inquiries which I had the honour to receive from you on the 22d April last, has been occasioned partly by absence from home, but chiefly by a desire to give the utmost consideration to a subject which is of great national importance, and which has come somewhat extensively under my observation at various times in connexion with public as well as private professional business.

I observe that the continuation of the engraved one-inch map is assumed as a matter of course; and upon the general excellence and public usefulness of that map it is impossible to express too strong an approval. I would only observe that contour lines on a scale of one inch to a mile are, in my opinion, not likely to be of any practical value commensurate with the cost which must attend any approach to extreme accuracy, and without such approximation the contour lines on so small a scale would be of little value.

The engraved six-inch map of Ireland appears to have answered admirably well for the specific purposes required in that part of the Kingdom; but I consider it to be wholly unsuitable as the scale for an engraved map of Great Britain generally. It is *much too large a scale* for *extensive purposes*, and *much too small* where *local exactness* is required. Many rural districts *require a larger and clearer scale*, and many others *do not require so large a scale of delineation*. The requirements of the case do not admit of *any one uniform scale* for large plans being generally suitable, and hence it is not surprising that a great number of contradictory, and yet very able opinions have been expressed, as to the proper *uniform scale* to be adopted for the enlarged maps.

What I venture to recommend, in conformity with your request, is *to continue and complete the engraved one-inch map; to discontinue the engraved six-inch map; and not to attempt the publication of an enlarged map upon any UNIFORM scale at all*. Instead of any uniform enlarged map, I propose to publish only what, for brevity's sake, I will now call *engraved skeleton lines*; the *present and future use, economy, and extensive application of these, to all places and for all purposes, I will endeavour briefly to state*.

Under any circumstances, or for any scale of a national map, the process of triangulation is requisite, first from principal, and afterwards from secondary stations, the exact positions of such stations admitting in most cases of being permanently preserved. Of lesser details, as to the convenient size or area of these lesser divisions of the triangulation, I do not now speak, as I wish only to invite attention to a mode of procedure which would go far to reconcile *all opinions as to scale*, and would, at the same time, afford very great advantages at a cost materially less than that of the publication of any general map of the Kingdom on a large scale, whether of six or twelve inches, or any other scale.

I propose that in connexion with well ascertained and permanent stations, derived from what may be considered as the great or trigonometrical survey, certain lines forming the boundaries of triangular or other areas, of from one to ten square miles in extent; these *straight boundary lines* ought to be surveyed with great care, and include objects within 44 yards on each side. These straight lines, embracing a width say of 88 yards, might be laid down in *draft plans*, to be preserved on a scale sufficiently large for any purpose in town or country; as for example, forty inches to a mile, and being in straight lines of small width might be registered so as to admit of easy reference. A page of twenty inches square, and on the scale of forty inches to a mile, or two chains to an inch, would hold five miles of such lines. A reduced index to these, on a scale of say four inches to a mile, would admit of 100 miles being very clearly indexed on a sheet of twenty inches square, and this index would present an accurate representation of all roads, fences, rivers, &c. crossing the line with also, what is of great importance, the exact position of certain fixed altitudes as at every 20, 50, or 100 feet, which in single straight lines could be levelled and fixed with an accuracy *suited for the most extreme exactness* of any purpose whatever, now, or at any future time. Such *contour points*, ascertained all over the Kingdom, would furnish all that is required for constructing any local maps or sections at any time, and I consider it would be sheer waste of time and money to contour millions of acres, where crags and ravines would oppose almost insurmountable obstacles to accuracy of detail, whereas these carefully ascer-

Replies to the
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in favour of other
scales.

tained points, on the registered and published lines, would present *the rigid exactness of mathematical and engineering data*. In addition to this it would be necessary to give a general outline or skeleton map, showing the general position of the accurately measured skeleton lines of the secondary triangulation.

As to the country generally, that very large portion of it included within the afore-named boundary lines, would in the first instance be surveyed only with reference to delineation on a one-inch map, to be proceeded in with all possible speed, as being unquestionably the first requirement of the public.

The very exact *admeasurement* on the ground of certain lines is necessary to form a basis for the one-inch map, and the manuscript registration of these lines would not in any material degree add to the cost of the *one-inch* survey.

The manuscript delineation of these lines on a scale of even 80 inches to a mile, or one-inch to a chain, would involve very little additional cost, and would form a very small proportion indeed of the cost of any manuscript delineation of a whole country on a large scale. The taking levels over such lines, and recording elevations at intervals even of 20, 50, or 100 feet, would be attended with a very small cost indeed as compared with the operation of contouring a whole country.

A uniform one-inch map is useful in every place, but there are thousands of square miles in Great Britain where a six-inch map would absolutely be of no use whatever; the engraved copies of which would probably not be bought even by the proprietors of moors and mountains destitute of minerals or other valuable products.

There are many districts where, from subdivision of property, or the value of land for building, mining, or other purposes, a six-inch plan would be much too small to be of any material use.

It is desirable that all possible speed should be used to complete a *one-inch* map over the whole Kingdom; but it is quite clear that some particular districts require a large scale map much more than others, and many districts require it so little that they probably would not give any portion whatever of the cost, if called upon to do so.

Now, with reference to these and similar considerations, I beg to observe that the plan I now propose would effect the following objects.

It would not in any material degree impede or add to the cost of the one-inch map, but would probably greatly facilitate it.

It would provide a permanent basis for future surveys of any part where such a preliminary outline measurement of skeleton lines had been completed. *The cost* of completing the area within any one or more of the triangles in manuscript, in lithograph, or on copper or steel plates, could be approximated at any time either by the Ordnance or by other professional surveyors; and the scale of delineation for such portion or district might be greater or less according to the specific requirements of each case. All *general public objects* are answered by a one-inch map, and by *furnishing data* such as I have indicated. I do not here attempt any minute explanations in detail, but I would observe that the requirements for large scale plans, whether of town or country, are chiefly of a local nature, and should partly be supplied from local funds. I suggest, therefore, that a proportion of one-half of the cost of the *large plans*, of whatever scale, should be paid by each town or district or proprietor requiring such enlarged plan. It would be open to the Ordnance Survey to complete such large plans; or they might be undertaken by professional surveyors; or certain modified plans of survey by the latter might be subject to some supervision by the Ordnance Surveyors, so as to combine a very extensive series of surveys along with a degree of general accuracy, which would be ensured by the basis I propose.

This method would enable the entire country to be *rapidly swept over with an exact skeleton survey*. This would at once afford an accurate outline of the Kingdom, and give the correct position of its towns, chief roads, and prominent parts of the coast; it would at once supply data of astronomical position of general distances, and form a sufficient basis for surveys, parliamentary or otherwise, *of every description*, being both now and at all future times brought within and checked by the exact lines of the Ordnance Survey. The public, when once in possession of the skeleton lines as data, might select in each district whatever portions are urgently required on a large scale; and there is no doubt that if the outlines of such a correct triangulation were published,

public and private enterprise would *very quickly* and *very correctly* fill up the areas. Maps of towns and counties would be published on various scales, the smallest of which would be amply sufficient to furnish detail and to fill in the areas of the one-inch map; and I do not hesitate to say, that the great object of a National Survey might be thus completed *within one fourth of the time, within one fourth of the cost, and with an immeasurably greater public utility for every purpose, now or hereafter*, than can be afforded by any six or twelve inch uniform engraved map of the Kingdom.

Replies to the
Treasury Circular
in favour of other
scales.

I consider that, apart from the specific objects required in Ireland, the engraving of either a six or twelve inch map would in the North of England, and in Scotland, be an absolute waste both of time and money. Time would be consumed in going over millions of acres, a six or twelve inch plan of which would be of no possible utility, whilst ill-drained towns and important mineral and other districts would be slowly biding their time; years after years would be thus lost, and thousands upon thousands of pounds spent for no practical benefit whatever; whereas, if the energies of the Ordnance Survey were at once directed to the rapid progress of a general secondary triangulation, with a careful *measurement* and *levelling* of its lines, and a *manuscript* delineation of these *lines* only; if this were done, and an index or skeleton map of reference published, the one-inch map might be completed from it with great rapidity, and every town or district or proprietor might at once proceed with large or small scale manuscript or engraved maps.

I am prepared to offer very full reasons in detail to show that the adoption of a system of this kind is the only one at all likely to meet the different views and purposes which have been claimed by different districts, and urged with great force and ability by many eminent professional gentlemen.

As I have never obtruded any views of mine on the subject, so I offer no apology for endeavouring to state those views, when required; and I do so with the greater willingness from a conviction, that whilst there can only be one opinion as to a good one-inch engraved map, the publication of an engraved six or twelve inch map will, as regards a great portion of Great Britain, prove AN ENTIRE FAILURE, and greatly disappoint many of the Town Councils and other bodies who have asked for its continuation, without a careful consideration of the details connected with the subject. Of the number and variety of the circumstances which have an important bearing on this subject, a perusal of the evidence on the Scottish Survey, and of the printed documents which accompany your letter, afford the strongest proof.

No. 57.

COMMISSIONERS OF SUPPLY, DUMBARTONSHIRE.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	- 24
For plans to be engraved for sale	-	- 12
For draft plans of towns for record	-	- 120
For plans of towns to be engraved for sale	-	- 60

It being understood that the results of the Ordnance survey will be separately published at a reduced scale of one inch to the mile, as mentioned in the foregoing letter.

To the Right Honourable the Lords Commissioners of Her Majesty's Treasury.

The Memorial of the Commissioners of Supply for the County of Dumbarton, in Annual General Meeting assembled, on 30th April 1853.

Humbly sheweth,

That the progress of the National Survey of Scotland, and the irregular manner in which that survey, so far as it has gone, has been conducted, have been found very unsatisfactory, and have led to complaints being made to your Lordships and to Parliament.

That your Memorialists learn with pleasure that there is now a prospect of the work being more vigorously prosecuted.

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scales.

That, in your Memorialists' opinion, it is of importance that the survey should be proceeded with, regularly and continuously from south to north, as recommended by a Committee of the House of Commons in 1851, and that it should not be in the power of the surveying officers to shift the men under their charge from county to county at their pleasure or caprice, or as political or private influence may sway.

Your Memorialists therefore pray your Lordships to take such measures as will ensure the regular and continuous prosecution of the survey from south to north, and its completion in a satisfactory manner within a reasonable time.

Signed in name and by appointment of the Meeting by

A. SMOLLETT, Chairman.

SPECIAL OBSERVATIONS.

Dumbarton, May 18, 1853.

The subscribers understand that the words "Rural Districts" apply to *cultivated* rural districts, and they do not consider so high a scale as is recommended above necessary for mountainous and waste tracts of country.

It is recommended that mountains and hills be delineated on the maps by "hill drawing and shading," and that contour lines be not used.

It appears to the subscribers that the six-inch scale would prove quite inadequate for most of the purposes which a public map ought to subserve, and that in a great national undertaking of this kind, any additional expense which the adoption of a larger scale than six inches may entail ought scarcely to be considered in obtaining a thoroughly accurate survey, and a standard map available for ordinary purposes.

Signed in the name and by appointment of the Commissioners of Supply for the county of Dumbarton, by a quorum of the Committee appointed at the Annual General Meeting of the county, on April 30, 1853, to consider and report on the scales for the Ordnance survey.

N. C. STEELE.

ALEX. CAMPBELL.

H. W. CAMPBELL.

JOHN M. HUSBAND.

P. DENNY, JUN.

No. 58.

THE COMMISSIONERS OF SUPPLY, COUNTY OF RENFREW.

RECOMMENDED.

	Inches to a mile.	
For draft plans of rural districts, as public records	-	-
For plans to be engraved for sale	-	-
For draft plans of towns for record	-	-
For plans of towns to be engraved for sale	-	-

SPECIAL OBSERVATIONS.

By the Commissioners of Supply of the county of Renfrew in Annual General Meeting assembled, 30th April 1853. Archibald Campbell, Esq., of Blythswood, Convener of the county, in the chair.

Adopted on the motion of J. Hall Maxwell, of Dargavel, seconded by Sir Michael Shaw Stewart, Bart.

The Commissioners of Supply of the county of Renfrew having had under consideration the correspondence, &c., respecting the adoption of the six-inch scale in 1840, and respecting "the relative advantages of that scale and of a still larger one;" and also the circular letter from the Treasury dated April 1853, are of opinion:

1st. That a general map on a scale of one inch to a mile, shaded so as to show in relief the physical features of the country, is of essential importance.

2d. That a scale of six inches to the mile is inadequate for the survey, and inapplicable to many civil purposes in which a national survey may beneficially be employed; and that an engraving on that size, while too large to be used as a map, is insufficient as a plan.

3d. That without venturing to specify the exact scale on which the draft plans of rural districts should be made for preservation as public records, or in which these plans should be engraved for sale, the Commissioners are of opinion that the latter should be of such dimensions as at all events to admit of an accurate admeasurement of the area; and that the former should be on a scale as large as can be granted, provided that the size does not interfere with the correctness of the reductions required for the outline plan and the one-inch shaded map. The Commissioners of Supply would further avail themselves of this opportunity to tender their thanks for the increased grant of money voted this year in aid of the survey in Scotland, and to express their hope that so important a work will be accelerated by all the means at the disposal of Her Majesty's Government for such purposes.

Replies to the
Treasury Circular
in favour of other
scales.

ARCH. CAMPBELL, Blythwood, Convener, &c.

No. 59.

POOR LAW BOARD.

RECOMMENDED.

			Inches to a mile
For draft plans of rural districts, as public records	-	-	26 $\frac{2}{3}$
For plans to be engraved for sale	-	-	-
For draft plans of towns for record	-	-	40 or 80
For plans of towns to be engraved for sale	-	-	-

SPECIAL OBSERVATIONS.

Whitehall, May 19, 1853.

I am directed by the Poor Law Board to acknowledge the receipt of your letter of the 20th ult. in which you transmit to them some correspondence and memoranda relating to the Ordnance Survey, and you request that the Board will inform the Lords Commissioners of Her Majesty's Treasury what scales they would recommend for any national survey which may henceforward be carried on at the public expense.

I am directed to state to you in reply, for the information of their Lordships, that the nature of the business in this Department connected with the surveys of parishes does not furnish the Board with sufficient practical knowledge on the subject to enable them to express any opinion as to the scale on which any national survey should be made.

The Board are empowered by the 6 & 7 Will. 4. c. 96 to issue their orders for a survey and map of any parish, where required for the purposes of parochial assessment, and since the passing of this Act they have issued, as shown in the enclosed return, 1,267 orders for such maps. In numerous other cases the maps made under the Tithe Commutation Act have been available for the same object. The Board have almost universally required that the maps made in pursuance of their orders should be on the scale of three chains to an inch in rural parishes, or two or one chain to an inch in town parishes, this scale having been determined upon at the commencement of the proceedings under the Act referred to, after communication with the Tithe Commissioners. The Board transmit, herewith, an extract from the minutes of the Poor Law Commissioners, and a copy of a letter addressed by them to the Tithe Commissioners on the subject.

When the maps made under the orders of the Board are sent to this office for approval, it has been the invariable practice, of the Poor Law Commissioners and this Board, to request the Tithe Commissioners to cause them to be examined by the scientific members of their Board and their surveying staff, and reported upon to this Board under an arrangement made for that purpose between the two Departments. The Board believe that the Tithe Commissioners have in no instance recommended the absolute approval of any map or plan, where the scale has been lower than that mentioned above, though under peculiar circumstances a scale somewhat smaller has been, on a few occasions, sanctioned. The Board have, in some cases, been requested to authorize the purchase of a copy of the Ordnance map for the purpose of being used in the valuation of a parish, but believing that the map is on much too small a scale to be available for the object required, they have been unable to give their assent to the proposal.

Whether a national survey might be made on such a scale that copies of maps of parishes could be obtained at a small expense, suitable for the purposes of paro-

Replies to the
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chial assessment, is a point which the Board think may be worthy of consideration, but upon which the Board do not possess sufficient practical information to offer any opinion beyond that which they have already expressed.

COURTENAY, Secretary.

Extract from a Minute of the Poor Law Commissioners on the subject of the Parochial Assessment Act, 12th September 1836.

That as respects the surveys and valuations necessary for carrying into effect the Parochial Assessment Act, communication be made to the Tithe Commissioners on the subject, with the view to the adoption of a principle and mode of survey and valuation, which may be applicable as well for the purposes of the Tithe Act as for the Parochial Assessment Act, and for any other public purposes for which a survey and plan may be necessary, provided that it shall appear that no material increase of expense shall be incurred.

Copy of a Letter from the Poor Law Commissioners to the Tithe Commissioners.

Poor Law Commission Office, Somerset House,

5th January 1837.

The Poor Law Commissioners for England and Wales have had under their consideration a Report made to your Board by your Assistant Commissioner, Lieut. Dawson, explaining his views as to the nature, scale, and construction of the plans which, in his opinion, will be required for the purposes of the Tithe Commutation Act.

The Poor Law Commissioners are sensible of the great advantage which will result, both to owners and occupiers of lands and other real property, and the public in general, from the adoption of the uniform and well considered system which is suggested in the Report, and which has received your sanction, and they desire to assure you that they shall have much satisfaction in furthering by every means in their power so judicious and useful a measure, and that in all cases in which, under the Parochial Assessment Act of last Session, it shall be deemed necessary that a plan of a parish or district shall be made, they will either adopt the plans made under the orders of the Tithe Commissioners, or will direct the plan required to be constructed on the scale and in the manner pointed out by Lieut. Dawson.

Signed, by order of the Board, E. CHADWICK, Secretary.

A STATEMENT showing the number of instances in which the Poor Law Commissioners have exercised the powers vested in them by the 3d section of the 6 & 7 Will. IV. cap. 96; that is to say, the number of Orders issued by them under this section from the 19th August 1836, when the Act was passed, to the 31st December 1852:—

Year.	Number of Orders for making a survey and valuation.	Number of Orders for making a survey, plan, and valuation.	Total.
1836	4	—	4
1837	1,135	216	1,351
1838	1,393	512	1,905
1839	369	140	509
1840	313	100	413
1841	132	43	175
1842	219	29	248
1843	226	27	253
1844	191	23	214
1845	126	25	151
1846	140	31	171
1847	164	30	194
1848	151	21	172
1849	100	18	118
1850	82	16	98
1851	132	14	146
1852	154	22	176
Totals	5,031	1,267	6,298

No. 60.

LOCAL DIRECTOR OF THE GEOLOGICAL SURVEY
OF IRELAND.Replies to the
Treasury Circular
in favour of other
scales.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- 24
For plans to be engraved for sale	- 6
For draft plans of towns for record	-
For plans of towns to be engraved for sale	-

SPECIAL OBSERVATIONS.

I should recommend the survey to be made on the scale of about two feet to the mile, in order that it may embrace all possible present and future uses. I should also recommend an immediate publication of a reduction of it on the scale of six inches to a mile, as being that which would serve the greatest number of present practical purposes, and also for the sake of having a large uniform map of the whole United Kingdom. The *uniformity* of such a map would of itself be a great advantage, whatever was its practical scale.

I am decidedly in favour of contour lines in preference to any system of "hill shading," and should wish to see the contours as close together as possible, that is, that their distance in vertical height should be made certainly not greater than twenty or thirty feet.

Geological Survey of Ireland, Ashford, co. Wicklow,
May 20, 1853.

As you have done me the honour to send me the "correspondence, &c." respecting the Ordnance Maps, and the Circular Letter, requesting an opinion as to the scale on which they ought to be published, I will, with your permission, take advantage of the present opportunity to lay before you my opinion on some points touched on in the correspondence in a little more detail than the space of the accompanying form would allow.

Having seen something of the principles of surveying while serving for four years as naturalist on board H.M. surveying ship "Fly;" having been subsequently for several years engaged in laying down geological details on the Ordnance *one-inch* maps, both in North Wales and in the important mineral district of South Staffordshire, as also on the *six-inch* maps of Ireland, I may, perhaps, be considered as capable of forming, and entitled to express an opinion, without being accused of presumption.

1. It is obvious, from the nature of the case, as well as from the calculations in the admirable letter of Mr. Vignoles (printed in the correspondence, &c.), that the principal cost of a great survey arises from the trigonometrical and geodesical operations, and not from the laying down the results either on paper or on copper. It is likewise apparent that an increase in the magnitude of the scale, and the corresponding accuracy and minuteness of these operations, by no means involves a *proportionate* increase in the cost. Mr. Vignoles shows, by comparing the one-inch map of England and the six-inch map of Ireland, that while the size or area of the map has been multiplied by 36, the cost of the survey has only been multiplied by 2½. Even in an economical point of view, therefore, it is obviously advantageous that a great national survey should be conducted on such a scale as should suffice once and for ever, and render unnecessary any future general trigonometrical and geodesical operations.

It appears from the "correspondence, &c." that a scale of something like two feet to the mile (one of Mr. Vignole's groups, D. and E.) would be an adequate scale for the construction of a map useful for all possible general and national purposes.

There can, therefore, in my opinion, be no doubt as to the advisability of the survey being conducted on that scale for the major part of both England and Scotland.

Now I believe—but on this point I have no practical experience—that when

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a general scale is fixed on for constructing the map of a country, it will be both easier and cheaper to plot the whole of the country on that scale, even though many parts should not seem to require it, than to introduce the complication of two scales intertangled one with the other. Whether that be so or not, as it seems impossible to foresee what may be the possible future requirements of any, even the wildest, tract of ground, it seems to me very short-sighted policy not to complete the entire survey on one uniform scale, even if the result should involve the exhibition of several sheets of blank paper here and there. These, if they never do any good, cannot possibly do any harm, and their cost will be comparatively little or nothing.

2. As to the question of engraving and publishing this great survey, it is a matter not so easily or simply decided. It may possibly be required hereafter to be published *in extenso* for purposes which do not at present exist; or particular parts may be required to be published either on the original scale, or on some comparatively slight reduction of it.

If it be kept as a great public document, and facilities of reference to it be afforded, and to the details of measurement resulting from it, with possibly manuscript copies of parts (to be made at the expense of those who apply for them), experience would shortly decide the question of the maximum scale advisable for publication.

I doubt whether any one is at present competent to pronounce an authoritative opinion on this point, when we consider the transition state of our legal and social condition, and the possible uses to which such a map may hereafter be applied.

In the meantime my own opinion is very decidedly in favour of the publication of a reduction of this map on the scale of six inches to the mile, as a detail map, adequate for a great number both of local and general purposes, together with the *simultaneous* publication of a combined general map on the scale of one inch to the mile. Independent of any arguments that might be brought forward in favour of these two scales in the abstract, I should be inclined to rate very highly the advantage of having published maps of the whole of the United Kingdom on these two uniform scales, and thus keeping a common standard of comparison, and a common ground of utility throughout. I do not think the unity of treatment, and the common basis of advantage and union of interest and ideas, resulting from the uniform scale of the maps of the whole United Kingdom, a matter to be altogether overlooked or despised.

For the present practical purposes with which I am best acquainted, those, namely, of the Geological Survey, I think there can hardly be a better scale than six inches to a mile on which to lay down the work, or than one inch on which to publish the results. After two and a half years experience on the Geological Survey of Ireland, I can speak in the highest terms of the utility, as well as of the accuracy and beauty, of the six-inch Ordnance Map of Ireland. Upon that map we are able to record our observations, showing the very field, or other exact spot, on which they were made, to lay down, without distortion or exaggeration, all the data *distinctly*, that is, without confounding them with the general results; we are thus enabled to construct a great public document of observed facts, independent of hypothetical conclusions or theoretical deductions, which will ultimately have a very high practical value. The scale of six inches to the mile is the least on which this could be done satisfactorily; it is, therefore, for that reason the best, as it enables the greatest number of data to be grouped within one glance of the eye. It is possible, however, that hereafter, either for mining purposes, or for those of "superficial" and agricultural geology, a still larger scale might be found advisable. If so, this will form one of the reasons for the future publication of a part or the whole of the great survey on a still larger scale than six inches to the mile.

As in the case of the great topographical survey, so in that of the six-inch geological survey, it would appear to me very advisable to make arrangements, in order to give to the public facilities of reference to it, at a small comparative cost, or to afford copies of the detail-survey of any district, together with reports, sections, and all other information possessed by the office, payment being made at a rate sufficient to cover the expense of the same.

For these reasons, my opinion would be in favour of a survey on the scale of about two feet to the mile, with an immediate publication of a reduction of that survey on the scale of six inches to the mile, together with the *simultaneous*

publication of a general and combined* reduction on the scale of one inch to the mile.

Replies to the
Treasury Circular
in favour of other
scales.

3. As to the question of the delineation of the vertical forms of the ground, either upon these or upon any other maps, my own opinion is so decidedly in favour of contour lines, that I can hardly state it too strongly. There seems necessarily to be almost as much difference between a contoured map and a "hill shaded" one, as there is between a real measurement-survey and an "eye-sketch" of a country. For geological surveying, contour lines would be most important and useful, giving at once more accurate information as to the average thickness and inclination of beds of rock, than could be derived from any mere local observations, often guiding the steps and diminishing the chances of error on the part of the observer, and, in many instances, leading to practical results that would not be thought of without them.

The objections brought against them in several parts of the "correspondence, &c." seem to be founded rather on their having been "few and far between" in some particular examples, than on any essential defect in the system of contours. If contour lines be only sufficiently numerous and close together, they answer every purpose of "hill shading," with the additional advantage of having a fixed definite value and meaning, not dependent on the varying skill and judgment of artists and engravers, quality of plates and presses, number of impressions, or capacity of appreciation on the part of the public. A six-inch map, contoured with lines twenty or thirty feet apart, in vertical height, proceeding at equal distances from the sea level to the summits of the highest ground, would be the perfection of a map for geological work, while it appears to me that its value would be very great for agricultural, engineering, and sanitary purposes.

I have little hesitation in saying that artistic and pictorial representation of ground, *when not founded on definite measurement*, should, in all cases, be avoided, except as mere matter of curiosity, and that even the finest examples of "hill shading" are of no practical value or utility. A single row of figures, giving the absolute heights above the sea, would be far more useful.

So far, however, from contour lines rendering pictorial representation impossible, I should conceive it quite possible to combine the two in the most complete manner. I should think it possible to represent shading, for instance, by fine lines running parallel to the contours instead of across them. As to the objection, that contour lines will not be visible in vertical or nearly vertical cliffs, it is obvious that in steep slopes they would become "shading," while even if they all merged into a single strong line, the value and meaning of that line would become apparent on the slightest possible consideration.

It should be borne in mind that the absolute practical utility of contour lines can never be weighed down by any amount of mere vague impression of form, or any gratification of taste conveyed by the "highest art" of hill shading. The maps should be adapted to the purposes of those who want to *use them*, and not of those who wish merely to look at them. Even should some little practice be required for acquiring the full use of them, that is no argument for omitting any of their sources or means of utility.

I have offered no opinion as to the proper scale for towns, because having no experience, nor any peculiar information on that point, I do not consider myself entitled to express an opinion, even had I formed one.

J. BEETE JUKES, Local Director

No. 61.

MR. A. SMOLLETT, M.P.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

* By "combined" I mean that if the large survey and its six-inch reduction be, as seems almost necessary, a county survey, the inch map should be published in continuous sheets over the whole Kingdom.

SPECIAL OBSERVATIONS.

House of Commons, May 23, 1853.

In filling up the prefixed form in the way I have done, it is not my intention to recommend, that a survey on the scale indicated should be extended over those barren wastes and rugged mountains which constitute so large a portion of the surface of Scotland, but that it should be confined to the *mineral, manufacturing, and cultivated districts only* of the country.

Neither do I wish to be understood as intimating any dogmatical preference of a scale of 24 inches to a mile, to one of three chains, or of other, even larger, dimensions (this being a point on which the judgment of the most scientific and practical authorities appears materially to differ), but merely to express my decided opinion that the former of these is *the very smallest* which can with any safety be relied on for computing the contents of fields and other minute parcels and subdivisions of property.

It appears to me to be most conclusively proved, from the correspondence and papers lately circulated by the Treasury, as well as from the evidence taken by the Select Committee of 1851, that the six-inch scale is inapplicable to a vast variety of useful purposes which a *truly national* survey should be made to subserve, and on many of which the tendency of recent fiscal as well as sanitary legislation is daily conferring additional importance. I am most anxious therefore that the present opportunity should not be lost of bestowing on the country the benefits of a survey which shall be capable of embracing as many as possible of these objects, the possession of which would, I feel persuaded, go far to reconcile the inhabitants of Scotland to the unjust and vexatious delays which have hitherto characterized the progress of the undertaking.

Any additional expense which might be incurred by this extension of the scale of survey would, in my opinion, be fully provided for by a moderate increase in the price of the engraved sheets, and by an abandonment of the process of *contouring*, in accordance with the unanimous recommendation of the Committee of 1851.

On this last subject, I wish to avail myself of the present opportunity to express my decided disapproval of the method proposed to be adopted by the officers of the Ordnance department, for delineating the physical features of the country on the one-inch general map by means of *hachure* shading from reduced *contours*, instead of hill sketching and shading.

It appears to me that to endeavour by these means to produce a correct and characteristic representation of such a country as Scotland, more especially of its highland and mountainous districts, would be as absurd, and likely to be attended with as unfortunate consequences, as resulted from the attempt to construct wearing apparel on similar principles by the tradesmen of Laputa, whose *modus operandi* has been thus described—

“He first took my altitude by a quadrant, and then with rule and compass described the dimensions and outlines of my whole body, all which he entered upon paper, and in *six days* brought my clothes, very ill made, and quite out of shape, by happening to mistake a figure in the calculation.”

Captain Gulliver comforted himself under his misfortune by the observation, “that such accidents were very frequent, and little regarded in Laputa,” but the inhabitants of Scotland will not even have this slender source of consolation, when after waiting for *upwards of sixty years*, they shall at last receive a distorted and unrecognizable delineation of their country, and contrast it with the beautiful and highly artistic representation of the principality of Wales.

No. 62.

COLONEL HUNTER BLAIR, M.P.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	24
For plans to be engraved for sale	-	6 and 1.
For draft plans of towns for record	-	120
For plans of towns to be engraved for sale	-	60

SPECIAL OBSERVATIONS.

Replies to the
Treasury Circular
in favour of other
scales.

I beg respectfully to suggest to the Lords Commissioners of Her Majesty's Treasury that the survey of the County of Ayr, in particular, should be completed and published without further delay, both on account of the proximity of the county to that part of Scotland already surveyed and published on a six-inch scale, and the importance of the county itself.

No. 63.

COMMISSIONERS OF SUPPLY, COUNTY OF AYR.

At a Meeting of the Commissioners of Supply of the County of Ayr, held at Ayr upon the 30th day of May 1853, in terms of adjournment from the Annual General Meeting of 30th April last, to receive the Report of the Committee of Inquiry as to the Ordnance Survey, appointed at that Meeting :

Present,

James Campbell, of Craigie.
T. S. Cunninghame, younger, of Caprington.
P. B. Mure Macredie, of Perceton.
E. Cathcart, of Auchendrane.
T. Davidson, of Drumley.
T. Hamilton, younger, of Cairnhill.
J. J. Burnett, of Gadgirth.
John Hamilton, of Sundrum.
P. W. Kennedy, of Drummellan.
H. Miller, Provost of Ayr.
Robert Robertson, of St. Ninians.
Bailie M^cMurtrie.

Mr. Campbell, of Craigie, in the chair.

The following Report from the Committee was read to the Meeting :-

Ayr, May 6, 1853.

At a Meeting of the Committee on the Ordnance Survey,

Present,

E. Cathcart, of Auchendrane, Convener.
T. S. Cunninghame, younger, of Caprington.
W. H. Crawford, of Crawfordland.
P. B. Mure Macredie, of Perceton.
J. J. Burnett, of Gadgirth.
Provost Miller of Ayr.

Mr. Cathcart in the chair.

The Committee having carefully considered the printed correspondence forwarded to the Commissioners of Supply from the Treasury, and examined the following Ordnance Maps, viz. :—

Two sheets of the five-feet plan of Liverpool.
Ditto of six-inch scale map of Lancashire.
Ditto of one-inch general map, containing the towns of Liverpool and Manchester, which sheets are shaded without the contours.
Four sheets of the six-inch map of Wigtonshire, and

Specimens of hill shadings with reduced contours ; and other documents, beg to report that, in their opinion, the questions submitted in the Treasury Letter of April 1853, should be answered as follows :—

		Inches to a mile.
1. For draft plans of rural districts, as public records	-	24
2. For plans to be engraved for sale	- - -	6 and 1
3. For draft plans of towns for record	- - -	120
4. For plans of towns to be engraved for sale	- - -	60

Replies to the
Treasury Circular
in favour of other
scales.

And that as "Special Observations," the following remarks should be made :—

1. With respect to the record plans of rural districts.

That no difference should be made in the County of Ayr Survey between the uncultivated and cultivated districts ; but the county, as a whole, should be surveyed on the twenty-four-inch scale throughout, and that none of the Record Surveys of Scotland should be on smaller scales than six inches and sixty inches, so as to enable the general map of Scotland to be engraved on these scales.

That it be left to the Government to decide which of the three methods, of contouring, ordinary hill shading, or a combination of ordinary hill shading and contours reduced, should be adopted in the record plans and engraved maps ; and also, at what height contours should terminate, and where the Record Surveys of Scotland should be on the six-inch, and where on the twenty-four-inch scale.

2. With respect to plans of towns.

That the record plans and engraved maps on the above-mentioned scales of one hundred and twenty inches and sixty inches, should be extended throughout to all towns in Ayrshire of three thousand inhabitants and upwards, instead of four thousand inhabitants, the limit as at present.

Generally.

That it is essential that the engraved plans for sale on the six-inch and sixty-inch scales for Ayrshire and the towns therein respectively, be completed without delay : and it is confidently hoped that no further time will be required for the completion of the work, if the larger scales of twenty-four inches and one hundred and twenty inches be adopted for the record plans, than if the smaller scales be retained ; but that the Government will furnish funds adequate for the execution of the additional work thereby occasioned, without any additional delay.

That the record plans and engraved maps of the County of Ayr, in particular, should be carried on, completed, and published with every possible energy, both on account of the proximity of the county to that part of Scotland already surveyed, and the importance of the county in itself.

The Committee authorize their Chairman to sign the above as their Report.

E. CATHCART, Convener.

The Meeting having heard the foregoing Report, it was moved by Captain Hamilton, younger, of Cairnhill, seconded by Mr. Robertson, of St. Ninians, that the Report be approved of, which motion was unanimously agreed to.

Extracted by DAVID SHAW, Clerk of Supply.

No. 64.

LIEUT.-GENERAL ARBUTHNOTT, M.P. FOR KINCARDINESHIRE.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	20
For plans to be engraved for sale	-	-	6
For draft plans of towns for record	-	-	60 and 120
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

The Albany, May 26, 1853.

1st. The measurements should be taken with sufficient exactness to be accurately laid down in general to a scale of four chains to an inch, or twenty inches to a mile, except in the mountain districts, where the six-inch scale should be adopted.

2d. All original maps to be preserved for reference.

3d. The system of surveying and mapping towns and their suburbs to the

scale of sixty inches to the mile should be extended to every populous place in the manufacturing and mineral districts, and in closely-built localities to double that scale.

4th. The whole of the survey should be engraved for publication on a scale of six inches to a mile.

5th. The original maps on the scale of four chains to an inch to be only engraved or lithographed when parties interested in any particular parish or district subscribe for the separate expense of so doing.

6th. The system of contouring to be continued, and the contours engraved on the six-inch map.

7th. That it shall be left to the judgment of the Ordnance officers to decide to what extent in the mountainous and uncultivated districts the measurements be limited for laying the maps down on the six-inch scale only, and that in like manner it be left to their judgment to settle the height at which the contouring should terminate.

8th. One-inch topographical maps to be engraved and published, and the hills and undulations to be defined therein by contour lines, and not by vertical hatching.

Replies to the
Treasury Circular
in favour of other
scales.

No. 65.

HIGHLAND AND AGRICULTURAL SOCIETY OF SCOTLAND.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	- (Larger than 6.)
For plans to be engraved for sale	-	-
For draft plans of towns for record	-	-
For plans of towns to be engraved for sale	-	-

SPECIAL OBSERVATIONS.

Edinburgh, May 25, 1853.

I am instructed by the Directors of the Highland and Agricultural Society to inform you, that they have had under their consideration your letter of 16th April in reference to the Ordnance Survey of Scotland, and the "correspondence, &c., respecting the adoption of a six-inch scale in 1840, and respecting the relative advantages of that scale and a still larger one."

The Directors would, in the first place, express on behalf of the Society, the gratification with which they learn that a map of one-inch to the mile "will, under any circumstances, be separately published." The Directors continue to entertain the opinion stated by them before the Committee of the House of Commons in 1851, that such a map is of essential and primary importance, and they trust that any decision which may be arrived at as to the best scale for the survey itself, and for the engraved plans, will be regulated by a view to the completion of a correct one-inch map at the earliest possible period.

The Directors have been desired by you to state the scale they would recommend.

1st. For draft plans of rural districts to be preserved as public records.

2d. For plans of these to be engraved for sale.

3d. For draft and engraved plans of towns.

On the latter point they would abstain from offering any opinion, conceiving it to be one more properly within the consideration of Town Councils and other municipal bodies.

With respect to the other queries they feel a difficulty in determining the exact number of inches to a mile which should regulate the scales for the draft, and for the engraved plans of rural districts. They entertain, however, a very decided opinion that the six-inch scale is unsatisfactory, and that engraved plans of that size would not be adequate for many important civil purposes to which a national survey should be subservient. Without presuming, therefore, to indicate any precise scale either for the drafts or for the engravings, they would express a hope that Her Majesty's Government may be enabled to afford one larger than six inches to a mile, provided the increased size does not interfere with the correct execution and speedy completion of the one-inch map.

Replies to the
Treasury Circular
in favour of other
scales.

In conclusion I am desired by the Directors to tender their grateful acknowledgments for the considerable addition made this year to the grant for the Scotch Survey. There exists a strong and general feeling that, with respect to the survey, Scotland has not hitherto been treated with justice; and the last vote has been accepted by the public as an earnest that, in future, the claims of this part of the country will not be overlooked, and that every effort will be made to accelerate the progress of so important a measure.

J. HALL MAXWELL.

No. 66.

HON. J. E. ELLIOT, M.P., AND THE COMMISSIONERS OF
SUPPLY, ROXBURGHSHIRE.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	- -	24
For plans to be engraved for sale	- -	12
For draft plans of towns for record	- -	(Larger than 5 feet.)
For plans of towns to be engraved for sale	- -	-

Excerpt from Minutes of Meeting of Committee of Commissioners of Supply of
Roxburgh, held at Jedburgh 28th April 1853.

The Convener laid before the Meeting a letter which he had received from the Hon. Mr. Charteris, along with certain papers regarding the Ordnance Survey in Scotland, requesting the opinion of the Commissioners of Supply whether the survey should be made on a six-inch or any larger scale.

The Committee having perused the said papers and considered the subject, recommended that the Commissioners should approve of a survey on a scale of twenty-four inches to a mile for the draft plans of rural districts to be preserved as public records, and twelve inches for plans to be engraved for sale, and for draft plans of towns for records, larger than five feet to the mile.

Excerpt from Minutes of Meeting of Commissioners of Supply, held at Jedburgh
30th April 1853.

The Meeting approve of the Report of the Committee as to the Ordnance Survey, and authorize the Præses to fill up the return in terms of the said Report, and forward the same as directed.

SPECIAL OBSERVATIONS.

7, Chesham Place, May 30, 1853.

Having no very decided opinion as to the best scale to be adopted in the maps of the Ordnance Survey I thought it right to refer the questions contained in your circular letter dated the 19th April to a meeting of the Commissioners of Supply of my county.

I have received in reply the accompanying extract from the Minutes of the proceedings of a Meeting held by the Commissioners on the 1st ultimo.

The only observation I am disposed to make is that a scale of twenty-four inches appears to me unnecessarily large.

J. E. ELLIOT.

No. 67.

LORD WROTTESELEY.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	- -	24 to 26 $\frac{3}{4}$
For plans to be engraved for sale	- -	12 to 13 $\frac{1}{2}$
For draft plans of towns for record	- -	} 60 to 120
For plans of towns to be engraved for sale	- -	

SPECIAL OBSERVATIONS.

Replies to the
Treasury Circular
in favour of other
scales.

20, Chesham Place, May 30, 1853.

It appears to me that the inquiries which I have had the honour to receive from you, as to the expediency of adopting a scale for the Ordnance Survey larger than the six-inch scale for rural districts and 60 inches for towns, should be classed under two distinct heads: 1st. Such as are subjects for consideration by the Government and Parliament; and 2ndly, Scientific queries proper to be addressed to and answered by professional persons, or experts, after the necessary data have been supplied by the resolution of the questions, which relate to administrative or legislative action.

Thus to explain my meaning, whether it be expedient that the Ordnance Survey should be on the two-inch or six-inch scale, or on a scale so large that the maps founded on it may, if required, properly assume the character of estate plans for country districts, and therefore subserve all those ends which such detailed plans are, in the opinion of professional persons, calculated to fulfil? This, I say, is a question coming under the 1st head to which I have adverted, and beyond the province of the professional referee, for it in fact resolves itself into this: What are the ends to be provided for in a National survey? On the other hand, assuming that such a detailed survey is expedient, and that the House of Commons is willing to grant the necessary funds, two simple questions, and such as fall under the 2d head above described, arise, which are meet and proper to be referred to experts, viz., 1st, What description of ends, speaking generally, will be subserved by a map of any given class? 2dly, What is the best scale to adopt for a map that is required to embrace certain given details? Thus it is for the legislator to say, whether the survey should provide for any special legislative requirement, &c.; for the professional surveyor to say, whether such requirement is provided for by any particular scale.

Now, on the first question above mooted, it would perhaps be more prudent to reserve an opinion, which, according to my view of the case, I am only entitled to give as a member of the legislature, till the subject comes before that tribunal in a regular form, and I have heard the arguments of those best qualified to enlighten me upon a matter of some difficulty; but as that event may never occur, and as the subject will not admit of delay, an immediate decision being called for, I shall not hesitate to lay before you the opinion which I have formed, premising, however, that it is not entitled to the weight of a reply after a full discussion in Parliament, and by the public, of the subject matter to which it relates, nor is it the opinion of one whose professional avocations have frequently directed his attention to questions of this description.

I am inclined to think that a national survey should be on a scale sufficiently large to fulfil every requirement that has been and may be created by legislative enactment, and that for many ages; it appears to me that the advantages likely to accrue from this more than outweigh any considerations of increased expense. Mr. Vignoles, in his able communication, shows, that the extension of the survey from the six-inch scale to that of 3 or 4 chains to an inch, will not probably cost more than 2*d.* an acre, and thus that the whole additional expense for the Scotch Survey will not exceed 160,000*l.* There are many, no doubt, who are likely to be deterred by these estimates from acceding to the proposition, but I would entreat them to remember how many thousands of pounds have, since the commencement of this century, been spent by parishes and other communities and private individuals in the preparation of maps for objects enumerated in Lord Langdale's and Mr. Vignoles' letters, and that serious obstructions have been created to the carrying out such objects, partly, if not entirely, from the want of such maps. I had the honour to be on the Committee of the House of Lords on the Registration of Assurances Bill; my former professional experience as a conveyancer, and my present as a landowner, both led me to the conclusion, that registration without maps would be imperfect, and I well remember the bitter feeling of disappointment with which I learnt, that after the great outlay of the nation on official surveys, no Ordnance maps existed of any county in England or Wales that could be rendered available for such a measure, and that for such a purpose maps as large as ordinary estate maps would be required. It is clear therefore that the course of legislation

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has already rendered it necessary that maps should be constructed embracing all the details of first-class estate plans.

It is said that it is folly to survey the barren tracts of Scotland and Ireland on the scale of an estate plan, but I would request those who descant on this supposed absurdity to reflect: 1st, That to *survey* a desert tract on a large scale cannot (inasmuch as there are scarcely any objects to insert) cost much more money, or very much more time, than to survey it on a small one, and that it is by no means necessary to *engrave* such districts on the same scale as the more cultivated. 2dly, That tracts, however barren, *may*, and probably will in future ages become seats of industry, and may at any time become mineral districts. 3dly, That uniformity is upon all accounts very desirable. I assume then that the survey should be on a sufficiently large scale to meet the above requirements, that is, to provide for all the objects set forth in the letters referred to, and such as are analogous, which may arise in future.

I am now therefore in a condition to reply to the two queries, that may be properly, as I think, addressed to persons qualified by their profession or former avocations to reply to them. I am perhaps scarcely within that category, but my experience, such as it is, would lead me to answer the first question by the general statement, that all such public or private objects as demand in rural districts full and detailed information as to the boundaries of local divisions and of tenements, as to the areas of fields, as to the buildings, &c., upon them, and the other details furnished by a good estate plan, may be subserved by a map of the class designated by Mr. Vignoles as class E., that is a map on a scale from 24 inches to $26\frac{2}{3}$ inches to a mile, to be engraved and published on a scale from 12 inches to $13\frac{1}{3}$ inches, that is scale C. As to towns, I have no experience, and I can only speak from the documents submitted to me, which seem to show that all the purposes of minute local improvement can be only provided for properly by surveys on scales, varying from 60 inches to 120 inches to a mile, according to the circumstances and nature of the locality.

The 2d query as to the *best* scale to adopt for rural districts, when such details are required as above-mentioned, is in fact answered within certain limits by the foregoing remarks, and as I think that it is not very important, which of the scales comprehended in E. is adopted, I should be disposed to leave the matter to the officers of the survey, who will be guided, no doubt, by considerations of technical convenience in the choice they make.

If it be objected that the surveys proposed to be made, and the maps founded on them, will in fact supersede all private surveys, and that it is not right that the Government should compete with individual enterprise, I answer that this consideration should not be allowed to interfere with a great public object, and a great public object no doubt it is, that such a survey of the Kingdom should be speedily set on foot, as will provide for all the legislative requirements of this and future ages, and constitute a record of the present state of real property, which may be appealed to with confidence throughout all time, and reflect a lasting honour on those who sanctioned and those who carried it to completion.

No. 68.

COMMISSIONERS OF SUPPLY, COUNTY OF EDINBURGH.

„RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - - -	$26\frac{2}{3}$
For plans to be engraved for sale - - - -	1
For draft plans of towns for record - - - -	-
For plans of towns to be engraved for sale - - - -	-

SPECIAL OBSERVATIONS.

Mortonhall by Edinburgh, May 28, 1853.

As Convener of the County of Edinburgh, I have the honour of informing you that your communication in regard to the scale of the Ordnance Surveys, and relative papers were laid before the General Meeting of the County held on the 30th ult., and were remitted to a large Committee for consideration, with

power to report their opinion to the Treasury. That Committee has subsequently met, and I am desired to inform you that they approve of a survey upon a scale of one inch to the mile to be published, as formerly proposed, for general use; and also of a survey upon the larger scale of $26\frac{2}{3}$ inches to the mile, to be made for agricultural and other civil purposes. But they desire me at the same time to express their reliance that no measures to be taken with regard to the larger survey shall be allowed in any degree to retard the publication of the smaller maps.

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scales.

RICHARD TROTTER.

No. 69.

COMMISSIONERS OF SUPPLY, KINCARDINESHIRE.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - - - -	not less than 20 in low country and 6 in hill country.
For plans to be engraved for sale - - - - -	6
For draft plans of towns for record - - - - -	60
For plans of towns to be engraved for sale - - - - -	30

The County of Kincardine concur in the conclusions arrived at by C. Vignoles, Esq.

SPECIAL OBSERVATIONS.

Stonehaven, June 1, 1853.

The County of Kincardine have hitherto applied for the survey on a scale of six inches to the mile for reference, and only one map on a one-inch scale, having been in doubt whether even that boon would be obtained within a reasonable time. But in the altered position of the matter, and looking to the increased demand for such surveys for statistical and scientific purposes, and in the belief that Government will now provide an adequate sum for conducting the survey on a suitable scale, and in a spirited manner, so as to secure the object of the late Parliamentary Committee as to its completion in the course of ten or twelve years, they have recommended, and would gladly obtain a survey on the larger scale before stated. It is, however, thought that if the large scale shall be adopted for scientific and national purposes, it will be necessary that the survey be also separately published, for common use, on a reduced scale of one inch to the mile; and, if necessary, the gentlemen of the county will not object to bear some part of the expense, either a contribution in money, or by subscribing for a certain number of copies of the map.

JAS. TINDAL, Clerk to County Meeting.

No. 70.

DUKE OF DEVONSHIRE.

Devonshire House, June 8, 1853.

I have the honour to submit to you my answers to the questions contained in your letter of the 23d April last, respecting the scale which I should recommend to be adopted for any national surveys to be carried on henceforward at the public expense.

I have adopted the form requested by your letter in communicating my replies, and I have added such observations as appear to me to be necessary.

DEVONSHIRE.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - - - -	20
For plans to be engraved for sale - - - - -	12
For draft plans of towns for record - - - - -	60
For plans of towns to be engraved for sale - - - - -	60

R

SPECIAL OBSERVATIONS.

I am of opinion that for the purposes of a National Survey the scale of six inches to the mile is decidedly too small, and that the larger the scale to which the original plans (to be preserved as public records) are drawn, the more valuable they will be. I am also of opinion that the maps on the larger scale will ultimately prove to be the most economical, inasmuch as the expense of future surveys will be avoided; which will not be the case if the scale of only six inches to the mile is adopted.

For some public objects the scale of six inches to the mile, adopted in Ireland, has been found to be sufficient; as, for instance, for grand jury purposes connected with roads; but, on the other hand, for the purpose of valuation, and to serve as a reference to such valuation, the scale has been found to be inconveniently small.

The maps profess to give all houses, buildings, and minute subdivisions of gardens, yards, &c.; but for this purpose the scale is too small, and when applied to purposes of valuation, considerable want of accuracy is the consequence. It is, moreover, difficult to follow or make out intricate boundaries on the six-inch scale.

I have in my possession a survey of my Irish estates, made in the year 1773 (now, therefore, 80 years old), and which, having been made upon the scale of 16 inches to the mile, has been a most invaluable document, and is so to the present day. Except in a few instances, my agents have not required any new surveys of townlands, which it has been recently necessary to re-value and re-let. If the Irish Ordnance Survey had been more completely adapted to the objects of an estate survey, I imagine it would have been much more useful and available in the proceedings of the Incumbered Estates Court, and I think that a National Survey ought to embrace such objects, and might then be of important service in many points connected with the transfer and conveyance of land, especially should a general registry of deeds be at any time established.

The above remarks apply to the original plans to be preserved as public records. For the purpose of engraving for sale, I think the maps will be more generally useful, and, therefore, that a greater demand will exist for them if they are published on a scale of twelve inches to the mile. I am not aware of any purpose for which the six-inch scale is now used which the twelve-inch scale will not equally well subserve; but, on the other hand, it is clear to me that the twelve-inch scale will answer for purposes for which the smaller scale would be insufficient.

I think the scale of five feet to a mile for towns will be sufficient for the original plans, and that for engraving and sale it will be better not to reduce the scale.

No. 71.

COMMISSIONERS OF SUPPLY, COUNTY OF PEBBLES.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	24
For plans to be engraved for sale - - -	12
For draft plans of towns for reco'd - - -	120
For plans of towns to be engraved for sale - - -	60

SPECIAL OBSERVATIONS.

It is assumed that a map, shaded, of one inch to a mile, will be also published for general use, and it is urged that this be forwarded without delay. Further, it is a matter of deep regret that a subject of such material importance should have been so much postponed, and it is earnestly recommended that the whole survey should be speedily forwarded by additional grants of money, and every available means which can be employed.

No. 72.

SIR G. G. MONTGOMERY, Bart., M.P.

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RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	24
For plans to be engraved for sale - - -	12
For draft plans of towns for record - - -	120
For plans of towns to be engraved for sale - - -	60

SPECIAL OBSERVATIONS.

With regard to the scales I have recommended, I have only to remark that I think the above are the smallest dimensions on which a survey should be made, which will fulfil all the requirements (such as the registration of property, the facilitating of public works and assessments, &c.) which a national survey should subserve. But considering no really good map of Scotland at present exists, I would urge that the execution of such a survey should not interfere with the speedy execution and completion of a one-inch map in the style of those of North Wales, which I believe to be quite as necessary and as much wanted as a survey on a large scale.

No. 73.

COMMISSIONERS OF SUPPLY, NAIRNSHIRE.

Viewfield, Nairn, June 6, 1853.

In answer to your circular of 18th April, I beg to state that having laid the papers therein referred to before the Commissioners of Supply for Nairnshire, at their Annual General Meeting on the 30th of April, they resolved that, in their opinion, the National Trigonometrical Survey should be carried on according to the following scales, viz. :—

	Inches to a mile.
For draft plans of rural districts, as public records - - -	26 $\frac{2}{3}$
For plans to be engraved for sale - - -	1
For draft plans of towns for record - - -	120
For plans of towns to be engraved for sale - - -	1

J. A. GRANT, Convener.

No. 74.

THE CHANCELLOR OF THE DUCHY OF LANCASTER.

Duchy of Lancaster Office, June 11, 1853.

With reference to your circular of the 20th April last, signifying the request of the Lords Commissioners of Her Majesty's Treasury that, after having attentively read the correspondence and memoranda transmitted to me with that letter, I would state, in the form thereto annexed, what scales I would recommend for any national surveys which might henceforward be carried on at the public expense, and that I would add any special observations I might have to make in support of my opinions; I beg to enclose my recommendation in the form prescribed, to which are added, under the head of "Special Observations," my reasons for the conclusions to which I have arrived.

EDWARD STRUTT.

RECOMMENDED.

	Inches to a mile
For draft plans of rural districts, as public records - - -	24
For plans to be engraved for sale - - -	12
For draft plans of towns for record - - -	120
For plans of towns to be engraved for sale - - -	60

R 2

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SPECIAL OBSERVATIONS.

I recommend the above increased scale for the plans of rural districts because it appears to me from the correspondence and memoranda which accompanied the Treasury Letter of 20th April 1853, that the purposes which a national survey ought to subserve would be satisfactorily provided for by such increased scale, which is not the case with respect to the six-inch scale, as experience has proved where the latter scale has been adopted; I am also of opinion that the reasons given by the late Duke of Wellington, in 1840, for then recommending the scale of six inches to a mile in preference to a smaller scale, would apply, with equal if not greater force, to the adoption of the still larger scale now recommended.

No. 75.

MESSRS. STEVENSON, SALT, AND SONS.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

20, Lombard Street, June 11, 1853.

I have carefully gone over the correspondence relative to the Ordnance survey, and send above, in reply to your letter of 22d April, addressed to Messrs. Stevenson, Salt, and Sons, my recommendation as to any future surveys that may be made in this country. The survey being made on a twenty-four-inch scale, and engraved on a twelve-inch scale, would, in my opinion, be available for more purposes than any other scale would be, and a reduction of these to a six-inch, three-inch, or two-inch scale for special purposes would then be easily accomplished, but a survey made on a lower scale than twenty-four inches to a mile would always leave something more to be desired. I have to apologize for the delay in answering your communication.

WM. SALT.

No. 76.

ABERDEEN MAGISTRATES AND TOWN COUNCIL.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	6
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

Town House, Aberdeen, June 9, 1853.

I am directed by the Magistrates and Town Council of this city, in reply to your letter of 21st April last, addressed to the Provost, to send you the prefixed memorandum of the scales which the Town Council of Aberdeen recommend for any national surveys which may henceforth be carried out at the public expense.

JOHN ANGUS, Town Clerk of Aberdeen.

No. 77.

LORD LOVAT.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	10 feet.
For plans of towns to be engraved for sale	-	-	5 feet.

SPECIAL OBSERVATIONS.

It is the opinion of the Committee that the above scales for rural districts should apply to the whole of Scotland.

No. 78.

ST. ANDREW'S UNIVERSITY.

University of St. Andrew's, June 14, 1853.

The University of St. Andrew's have the honour of transmitting to you, to be laid before the Lords of Her Majesty's Treasury, their answers to the queries transmitted to them by the Treasury in a paper dated Treasury Chambers, 18th April 1853.

JAMES McBEAN, Secretary to the University.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

The University are of opinion, that while the large scale is necessary for the manufacturing, mining, and cultivated districts, and even such districts as are susceptible of cultivation, the scale of one inch may suffice for mountainous parts, which form a large portion of Scotland and a considerable portion of Wales and the North of England.

ROBERT HALDANE, Vice Rector.

No. 79.

BOARD OF SUPERVISION FOR RELIEF OF THE POOR IN SCOTLAND.

Board of Supervision, Edinburgh, June 18, 1853.

I am directed to inform you, that the Board of Supervision for the Relief of the Poor in Scotland have had under their consideration your letter of the 20th April, with the correspondence and memoranda relative to the Ordnance Survey of Scotland; and I am instructed to transmit to you the recommendations of the Board in the form which you enclosed, together with a copy of a Minute which the Board have passed in reference to the subject.

W. S. WALKER, Secretary.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	26 $\frac{2}{3}$
For plans to be engraved for sale	-	-	1
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

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SPECIAL OBSERVATIONS.

Excerpt Minute of Board of Supervision, 16th June 1853.

The Board took into consideration the questions addressed to them as to the scale on which it is desirable that the Ordnance Survey of Scotland should be mapped, first, for record, and second, for publication.

The Board are of opinion that it is of great importance to the country that the costly survey now in progress should put it in possession of a map for record, which, with every security for its accuracy, shall be on such a scale as will make it available as an authoritative record for purposes of rating on the annual value of lands and heritages in the rural parts, and for sanitary improvements in the towns. It appears to the Board that for these and other public purposes of the greatest importance it is necessary that the map for record should be on such a scale as will admit of delineating the limits of every separate rural tenement, and that for such purposes it would be unsafe to trust to a map on any smaller scale than twenty inches to the statute mile. They are disposed, with reference to the class of persons composing some of the public bodies, who would have occasion to refer to such a map, to prefer a still larger scale, viz., three chains to the inch, or $26\frac{2}{3}$ inches to the mile for the rural parts, and ten feet to the mile for towns. They have reason to believe that the experience of the Tithe Commutation Commissioners, the Inclosure Commissioners, the Sanitary Commissioners, and the practice of parishes and public bodies, who have had surveys made for similar purposes, justifies that opinion. It appears that in many cases the public bodies and individuals who have had occasion to use maps for these purposes have found it necessary to incur the expense of a second survey when the result of the original survey was mapped on too small a scale to admit of accurately delineating the limits of every tenement; and that in these cases the scale of three chains to the inch has generally been ultimately resorted to.

The poor-rates, prison-rates, and various other local rates in Scotland are assessed on the annual value of lands and heritages; but the same property is generally assessed on different values for the different rates; and properties in different parts of the country are valued on totally different principles for the same rate. If at any time it should be deemed necessary or expedient to have a general re-valuation on one uniform system for all local rates, the value of a record map on a sufficient scale to give the limits of every separate tenement would for that purpose be inestimable. On the other hand, it appears to the Board that for all purposes of local taxation affecting land, for the valuation, registration, or transfer of landed property, for all purposes connected with agricultural statistics, and many other matters of national importance, the survey must be comparatively of little value, unless it puts the country in possession of a map for record on which the precise limits of every separate tenement can be pointed out and measured.

The Board are of opinion that a map of three chains to the inch being deposited for record, with power under proper limitations to obtain tracings for local purposes, and to have portions engraved at the cost of parties who may desire it, all other purposes would be sufficiently served by the publication of the survey on a scale of one inch to the statute mile.

The Board are of opinion that the engraved surveys of towns ought to be on a scale of sixty inches to the mile.

No. 80.

LIEUT.-COLONEL HON. L. MAULE, M.P., SURVEYOR GENERAL
OF THE ORDNANCE.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	24
For plans to be engraved for sale	12
For draft plans of towns for records	5 feet.
For plans of towns to be engraved for sale	

SPECIAL OBSERVATIONS.

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scales.

Ordnance Office, June 23, 1853.

In reply to your circular letter of the 19th April 1853, requesting my opinion "between the scale of six inches and any larger scale," with reference to the Ordnance Survey of Scotland, I have now the honour to state, that after a careful consideration of the whole question, I have come to the conclusion that for *general purposes*, a survey on a scale of twenty-four inches to the mile, with engraved plans on a scale of twelve inches to the mile, would prove of superior advantage to a survey on the six-inch scale.

I beg, at the same time, to express my sincere hope that, in the consideration and determination of this matter, the adoption of any larger scale of survey for Scotland, which must necessarily be a work of time, may not be allowed to interfere with the general and anxious desire of the people to possess, with the *least possible delay*, an useful map applicable to the general wants of the country. I would therefore strongly recommend that whilst the large plan, if adopted, be proceeded with gradually, a map of Scotland should be given to the *present generation* upon the one-inch scale, as applied to North Wales, whereby we should be the sooner relieved from the actual difficulty and discredit of being without any map whatsoever.

The scale for the survey of towns might, as a general principle, be limited to five feet to the mile, and might be increased according to circumstances and local arrangements with regard to the difference of expense.

No. 81.

THE EARL OF ROSSE.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	20
For plans to be engraved for sale	-	-	1
For draft plans of towns for record	-	-	60
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

13, Connaught Place, June 27, 1853.

I received the queries respecting the survey of Scotland at a time when my hands were pretty full of scientific work, and I laid them aside perhaps too long. In the interval, however, I have had an opportunity of consulting my agent in Ireland, under whose direction a survey of my estates there is at present in progress, the Ordnance Survey having been found insufficient for estate purposes. Upon the whole I think it desirable that the scale of the original maps should be four chains to an inch, or 20 inches to a mile; that is the scale upon which my surveyor is proceeding. For towns the scale should be double at least, better threefold. For our bogs the common Ordnance Survey of six inches to the mile is amply sufficient, and for the large barren tracts in Scotland of little value and incapable of profitable improvement, the expenditure may be very trifling, the map may be almost blank. I think the engineer in charge of the survey should exercise an unfettered discretion as to the details to be introduced into the maps of the Scotch waste land.

As to contouring it appears to me to be worth the expense, provided it is carried out judiciously, no more being done than is likely to be useful.

I think it would be unnecessary almost at first to engrave a map on a larger scale than one inch to the mile; that would be sufficiently large for all the ordinary purposes of a map, and it would even be sufficient for the engineer who was making a preliminary examination of a district for a canal or railroad.

Before the engineer proceeded to make his own survey, no doubt he would procure a trace of the original map on the 20-inch scale, which would be invaluable to him; and the landed proprietor, with such a trace worked into convenient maps, would require no other estate survey. It is very probable that photography has advanced far enough to make it practicable to copy in an effective manner the original map, and so supply the copies of individual sheets

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as required. It is not likely that many copies would be called for; the landed proprietor would probably in most cases take one, the parish another, and, except where some engineering work was in contemplation, I do not see that a third copy would be required. It evidently therefore would be useless, while it would be a very great expense, to engrave so large a map.

Should circumstances hereafter arise, which I cannot foresee, rendering it expedient to publish a map on the six-inch scale as in Ireland, the materials would be ready at hand.

No. 82.

MR. WALTER COULSON, Q.C.

5, New Street, Spring Gardens, June 30, 1853.

With reference to your letter of the 22d April, which I had the honour of receiving, concerning the scales to be recommended for national surveys, I beg to submit, for the consideration of the Lords Commissioners of the Treasury, the enclosed memorandum with reference to England only. Having reference to the difference between the two parts of Great Britain as to the state of landed property, and the laws concerning the transfer of land, rates for the relief of the poor, and other matters in which a national survey may be of importance, and to my imperfect acquaintance with the law and usage of Scotland, I am not entitled to express an opinion as to the scale which may be adequate for that part of the Kingdom.

RECOMMENDED (for England).

	Inches to a mile.
For draft plans of rural districts, as records	26 $\frac{2}{3}$
	(or 3 chains to the inch.)
For plans to be engraved for sale	the same.
For draft plans of towns for record	120
For plans of towns to be engraved for sale	the same.

SPECIAL OBSERVATIONS.

As a member of the Registration and Conveyancing Commission, I had to spend much time in considering the use of maps or plans for the registration of assurances, and for facilitating the transfer of land. For these purposes, maps or plans on a large scale founded on a scientific survey, appeared to me absolutely essential.

I think that those scales which have been found most suitable by experience in the business of the tithe commutation for rural districts, and for drainage in the town districts, would be the best, and that no scales much less than those would be adequate for facilitating the transfer of land in England.

On the lowest estimate of the value of these plans with reference to the transfer of land alone, it appears to me that any increase of the expense occasioned by draft plans on the scales I have proposed, would be compensated by the increased utility of the larger scales, and the transfer of land is but one of many important purposes for which only plans on a large scale can be used.

The subject, however, has been so fully and, to my mind, so conclusively treated in the communication of Lieutenant Colonel Dawson, that it is unnecessary for me to add further to the bulk of the communications on this subject.

No. 83.

MARQUIS OF TWEEDDALE.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	24
For plans to be engraved for sale	1
For draft plans of towns for record	
For plans of towns to be engraved for sale	

SPECIAL OBSERVATIONS.

Replies to the
Treasury Circular
in favour of other
scales.

Yester, July 4, 1853.

I have been prevented by various causes from giving my attention to the letter I received from the Treasury Chambers, dated 28th April ultimo.

I feel much more able to state what I think are the wants of the public in regard to an Ordnance map, which a national survey should provide, than to give an opinion on the scale sufficient for laying down the details of all the information required.

It appears to me that the results of the Ordnance Survey published separately on the reduced scale of one inch to the mile, will be the most convenient size for general purposes.

At the same time it would be a great accommodation if a general survey of the boundaries of the cultivated land of Scotland (to be kept as a record) was made for the use of the public, open at all times for their inspection, and from which any portion might be copied by individuals, for filling up in detail such parts of it as their private interests might require. A plan of such a survey would in my opinion be available for almost all practical purposes, such as the determination of parish boundaries, the delineation of not only every separate portion of property held by each individual, but also of the occupancy thereof by proprietors or tenants.

The boundaries of farms and tenements could be laid down, and their subdivisions into fields would be distinct.

The general position of drains, the peculiar kinds of fences, gates, roadways, &c., could be registered, and with the exception of the minute details of buildings, every necessary particular could on such a plan be defined.

To publish on this scale might be too costly and too extensive an undertaking for Government, but from such survey plans on any lesser scale could be prepared, and be published by individuals.

A six-inch scale of survey would not supersede the necessity of proprietors having larger and more minute plans of their estates.

A 24-inch scale of survey for reference would be valuable for checking every kind of local assessment on heritable property, as well as assist the collectors and surveyors of the property tax; and for public purposes, in connexion with the one-inch maps, might in many cases supersede new surveys for roads, and railways, exchanging of lands, and straightening of marches.

It appears to me that such a survey should give the number of acres in each inclosure, so as to make it a perfect survey for all parties possessing or renting land.

The survey of my own estate was made by an eminent surveyor in Scotland on a scale of 12 or 16 inches, and I am informed that had it been made on a scale of 24 inches, it would have embraced all the objects essential for the information of those who possess the various kinds of property held in Scotland.

There is no greater want on an estate in these times of improvement, than a register of the parallel drains and of the main drains into which they empty themselves, so that if any become choked, the line of drain may be ascertained by reference to measurement on the plan of the field.

In like manner sewers of all descriptions can be laid down with accuracy.

Also the lines of pipes, conveying water to houses or towns, dams across rivers with the side water-courses from rivers to mills; the spots where well-heads before the general drainage commenced were to be found in fields: there are other objects which I need not enumerate.

It is unnecessary for me to do more than to allude to the advantage it would confer on the mineral interests to have within their reach a map on the 24-inch scale. I cannot conceive a greater convenience for persons possessing land, woods, minerals, or any kind of fixed property, than to have it in their power to refer to and take a copy of such portions of a survey map as they may require.

HON. CHARLES GORE, COMMISSIONER OF WOODS, &c.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	26 $\frac{2}{3}$
For plans to be engraved for sale	8
For draft plans of towns for record	60
For plans of towns to be engraved for sale	60

SPECIAL OBSERVATIONS.

Office of Woods, &c., July 13, 1853.

With Sir C. E. Trevelyan's circular letter of the 23d April last there was transmitted to me printed copies of certain correspondence and memoranda, describing, first, the grounds upon which it was determined, in 1840, to publish the Ordnance map on the scale of six inches to the mile for the country, and five feet to the mile for towns; and secondly, the opinions recently given on the question, whether the purposes which a National Survey ought to subserve would be more fully provided for by an increased scale; and how far such increased scale would involve increased expense; and I was requested, after having carefully read the papers, to state to your Lordships, in the form thereto annexed, what scales I would recommend for any national surveys which may henceforward be carried on at the public expense, and to add any special observations I might have to make in support of those opinions, it being assumed that the results of the Ordnance Survey will, under any circumstances, be separately published on the reduced scale of one inch to the mile; and the question upon which an opinion was asked being merely between the scale of six inches and any larger scale.

On the receipt of those documents, I thought it proper to consult the local officers of this department employed upon the surveys of the Crown estates; and, with that view, I forwarded copies of the same to Mr. Higgins, Mr. Clutton, and Mr. Day, the three Receivers of Crown Rents in the country; to Mr. Pennethorne, the Architect and Surveyor for the Crown property in London; and also to Mr. Josiah Parkes, C.E., who is extensively employed by this department in matters relating to the drainage of the Crown estates, and consequently well qualified to offer an opinion upon the question; and I requested them to give their best consideration to this important subject, and to furnish me with their opinion as to the scale upon which, having reference to the various purposes which a national map may be required to serve, it would be most advantageous for the public and for the Government that the survey should be completed, together with such observations as might fully explain the grounds of their recommendation.

Having regard also to the various purposes for which surveys and maps are required in the general management of estates, I requested those gentlemen to state to me their opinions whether a plan on the scale of six inches to the mile can be adopted for the purpose of laying down drains, or for the other general purposes for which an ordinary estate map is used, and if not, in what respects such a map is insufficient, and what scale is requisite for such purposes.

The opinions given by those gentlemen respectively are as follows:—

Mr. Higgins states that (1) a map for the general purposes of topography or a guide through a district of country, delineating the towns, villages, roads, rivers, railways, and other principal objects, actually laid down upon a scale of one inch to a mile, will in his judgment, answer every necessary and useful purpose of that kind; and a similar map upon a scale of six inches to the mile will not afford any great public advantages, and will be cumbrous, and yet much too minute for field valuations.

2. A map for the general purposes of valuations, tithe commutations, parochial assessments, or the sale of land, ought not to be upon a less scale than six chains to the inch, or 13 $\frac{1}{3}$ inches to the mile; and for the purposes of an inclosure it should be three chains to the inch, or 26 $\frac{2}{3}$ inches to the mile, which alone can be depended upon for accuracy in working out the allotments.

And he adds that he entirely concurs in the opinions so ably expressed by Lieut.-Colonel Dawson, in page 28 of the published correspondence on this subject.

Mr. Clutton states, that he recommends a scale of twenty inches to the mile, because it is the least on which areas can be computed, drains laid out, and the general purposes of an estate map subserved; unless that scale is adopted, the necessity for an estate map of each separate estate is not obviated.

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He recommends for engraving, a scale of eight inches to the mile, as affording, within a moderate compass, a view of a considerable extent of country, and being a convenient medium between the one-inch published map and the twenty-inch plan for private purposes; and it is sufficiently large for the delineation of the natural divisions of the country, and the parochial and other territorial boundaries.

Mr. Day states (1) that a scale of six inches to the mile is not sufficiently large for a working plan.

2. That a scale of twenty-four inches to a mile (about three chains to an inch) is required to admit of sufficient details being planned for quantities, distances, &c. &c., being ascertained, and for any intended works being laid down.

The first-class tithe commutation and parochial assessment maps are made on this scale (twenty-four inches to the mile), the second-class twelve inches to the mile; and he adds that he has consulted the most experienced land surveyor in the county of Norfolk before giving these answers, and which, being confirmed by him, he therefore offers with reliance on their correctness.

The information with which Mr. Parkes supplied me was solely confined to the scale necessary for a map required for laying down and recording accurately the details of land drainage works, in regard to which he has informed me that the smallest scale of map on which drains can be laid down with the requisite accuracy is four chains to the inch, or twenty inches to the mile.

From this statement your Lordships will perceive that the local officers of this department concur in opinion that the six-inch scale is inadequate to answer the purposes of an estate map, and that their opinions as to the scale necessary for maps for valuations, and the ordinary purposes of the management of estates, vary between the scales of 20 and 26 $\frac{2}{3}$ inches to the mile.

In corroboration of the inadequacy of the six-inch scale for purposes of valuation, I may state that the Crown is possessed of an estate on the north bank of the River Humber, comprising about 6,800 acres, generally in large divisions, called the Sunk Island Estate, and a re-valuation having, in the month of April last, become necessary, I procured from the Ordnance department a tracing of the six-inch Ordnance Survey of the estate; and, inasmuch as they informed me that they were unable to put the quantities of the parcels, because the scale was not sufficiently large to afford areas by computation from the paper to any degree of minute accuracy, and that to get accurate areas it would be necessary to plot the work on double (i.e. the twelve-inch) scale, I obtained from them the approximate quantities of the several subdivisions, and transmitted them with the map to Mr. Higgins, by whom the valuation was to be made.

In reply, he informed me that he could not make it available for the purpose of his valuation, inasmuch as a perfect book of reference, containing the exact quantity, was indispensable, the scale being much too small to distinguish the drains, roads, buildings, or other principal objects with sufficient accuracy.

The total quantity of the estate, as ascertained by the Ordnance measurement, varies from the measurement deduced from the enumeration of the several parcels, to the extent of about 19 acres.

When the drainage of the Phoenix Park was in progress in 1846, it was deemed by the Commissioners of Woods of great importance to have laid down accurately upon a plan the exact course of the drains.

At that time there existed an Ordnance plan of the Phoenix Park, made upon a scale of six inches to the mile, as well as an earlier plan that had been made specially for the Commissioners of Woods, upon a scale of sixteen plantation perches to an inch; but as neither of these plans were sufficiently large for the purpose, a new survey and plan had to be made.

Another estate of the Crown, called the Woodhouse Grange Estate, in the East Riding of York, having this year fallen out of lease, it became necessary, for the purpose of extensive drainage works and re-valuation, to have a new survey and plan made, which has been done, upon a scale of 26 $\frac{2}{3}$ inches to a mile.

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A considerable portion of Windsor Great Park being now in course of drainage under Mr. Parkes, it became necessary to have a survey made on the same scale as the Woodhouse Grange Estate, for the purpose of recording the results of the drainage.

Founded upon the evidence which I have quoted herein, as detailed, and my own practical experience, I have filled up the Schedule with the several scales which I would recommend for the National Survey henceforward to be carried on at the public expense.

No. 85.

SIR DAVID BREWSTER.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	12
For plans to be engraved for sale	-	6
For draft plans of towns for record	-	10 feet.
For plans of towns to be engraved for sale	-	5 feet.

No. 86.

MR. E. H. J. CRAUFURD, M.P.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	24
For plans to be engraved for sale	-	6
For draft plans of towns for record	-	120
For plans of towns to be engraved for sale	-	60

SPECIAL OBSERVATIONS.

2, Paper Buildings, Temple, July 25, 1853.

I have submitted your communication and the accompanying correspondence and memoranda to the Magistrates and Town Council of the Burgh of Ayr, and I beg to return the blanks as filled up by them.

I venture, however, in some degree, to differ from the above recommendation.

I am strongly of opinion that the six-inch scale for rural districts would prove of little practical utility; that for general purposes, a *one-inch* scale would be sufficient; but that for purposes of reference, of registration, and of valuations the scale ought to be *at least twenty-six inches* to a mile in rural districts, and *one hundred and twenty inches* to a mile in towns.

The question of the simplification of the transfer of land depends essentially on the formation of a good registration map, on which the changes of boundaries and the varying subdivisions of fields and plots of ground can be clearly marked; and with a view to the formation of such a map, my only doubt is, whether a *twenty-six-inch* scale for rural districts, and *one hundred and twenty-inch* scale for towns, be sufficiently large.

No. 87.

MR. JAMES MACGREGOR, M.P.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	20
For plans to be engraved for sale	-	1
For draft plans of towns for record	-	60
For plans of towns to be engraved for sale	-	20

SPECIAL OBSERVATIONS.

South Eastern Railway, London Bridge Terminus,
July 14, 1853.

Replies to the
Treasury Circular
in favour of other
scales.

In compliance with the request of the Lords Commissioners of Her Majesty's Treasury, notified in your letter of 20th April last, I have now the honour to lay before you the annexed memoranda of my recommendations, &c. for any national surveys which may henceforward be carried on at the public expense.

1. The draft plans preserved as public records to be plotted to the above scales. Parties making application to be furnished with certified copies on payment of fees.

2. One inch to a mile sufficient for all purposes as a map.

3. Six inches to a mile too large for a map not large enough for a plan.

No. 88.

THE LORD ADVOCATE.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	- 24 or 26 $\frac{2}{3}$
For plans to be engraved for sale	-	- 12
For draft plans of towns for record	-	-
For plans of towns to be engraved for sale	-	- 120

SPECIAL OBSERVATIONS.

London, July 27, 1853.

I have no hesitation in strongly expressing my opinion in favour of the larger scale as far as my means of information enable me to form an opinion on the question. It may very probably be true that for engineering purposes, and other objects of the same description, the six-inch scale would be more convenient, but that is by no means the most important end which these plans are intended to serve, and it appears to me that it would be very unfortunate to lose this opportunity of constructing them on such a scale as to form a permanent record of the features and subdivisions of the country, such as may not only be of value in daily transactions and for financial and sanitary purposes, but may subsist as a standard of authentic reference for the future.

Of these two objects, convenience in their use and handling, as compared with fulness and accuracy in their details, I would give much more weight to the last, both because maps or plans on the larger scale may at any time form a correct basis for a reduced copy, and also because the delineation of fences and subdivisions, on a scale sufficiently large to be made the subject of reference, extends the utility of the survey to many classes of important purposes which the smaller scale would entirely exclude. The perfection of such a survey would be to have it so framed as to be a safe basis for the transfer of land and for all assessment valuations, and it would be difficult to estimate too highly the great convenience which would be thereby afforded in the conduct of ordinary business, or the immense saving of expense, both public and private, which would result from it. The scale recommended may perhaps not be altogether sufficient to accomplish these objects entirely, but it will certainly be attended with many of their advantages, and be of great service to the public.

These general remarks apply with equal force to rural and urban districts, though, of course, the more minute subdivisions of the latter make a larger scale necessary.

I have not sufficient practical knowledge to enable me to express an opinion on the relative expense of the different scales proposed.

J. MONCREIFF.

Replies to the
Treasury Circular
in favour of other
scales.

No. 89.

THE REV. D. DEWAR, D.D., LL.D., PRINCIPAL OF ABERDEEN
UNIVERSITY.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	12
For plans to be engraved for sale	both 6 and 1
For draft plans of towns for record	120
For plans of towns to be engraved for sale	60

No. 90.

MR. THOS. HUSKINSON.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	26 $\frac{2}{3}$
	(or 3 chains to an inch.)
For plans to be engraved for sale	13 $\frac{1}{3}$
	(or 6 chains to an inch.)
For draft plans of towns for record	120
	(or 10 feet per mile.)
For plans of towns to be engraved for sale	60
	(or 5 feet per mile.)

SPECIAL OBSERVATIONS.

Epperstone, Southwell, August 2, 1853.

Having carefully perused the copies of correspondence and memoranda which your Lordships have done me the honour to submit to me, relative to the scales which it is desirable should be adopted in any national survey, I beg most respectfully to submit the following observations to your Lordships consideration.

That all surveys and plans of a national character, though proposed with a view to a great variety of objects, may well be comprehended under two distinct classes.

1st. Maps which are not intended to be used with other documents for the purpose of imposing any charge upon private property, or for affecting in any way the title and possession thereof.

2d. Maps which are intended to affect private property, either by way of tax, rentcharge, or in respect of title, transfer, or exchange.

The chief uses of the first class of plans are for general consultation as a road or travelling map. For making a preliminary selection and survey of roads, canals, railways, and other works embracing a large extent of country which it is necessary to condense and comprehend in one view.

The present Ordnance Map, on a scale of one inch to a mile, has always struck me as most admirably adapted for these purposes. I know that it has been extensively used, and has rendered most valuable aid in selecting lines of railway in all parts of the country. For this class of maps I do not think a more convenient scale could be adopted.

For the second class of maps, affecting individual interests and estates, it is an *essential* condition that the scale should be sufficiently large to show the position, extent, and boundaries of each separate estate; and it is a very desirable condition that the scale should be large enough to admit of the area of each estate being computed from the plan itself.

A map combining these two conditions would be a perfect document, affording the means of exact identity, and carrying on the face of it the means of testing its own accuracy.

The purposes which such a map would serve are even now very numerous and important, and the wants of modern society, and the tendency of legislation to supply such wants, are yearly making large additions to these purposes. Amongst existing objects, I may mention parochial and county assessments, for which many surveys are now in progress. Tithe apportionments, which, although complete in its first process, re-apportionments from sale, inclosure, or other causes will be constantly recurring. Inclosure of commons, drainage of lands, sewerage of towns, copyhold enfranchisements, land tax redemption, to

which may now be added duties on successions, and, no doubt, shortly a registration of deeds. *All* these objects impose in one way or other a charge upon lands, and many seriously affect the title; it is, therefore, of great importance to the security, economy, and success of these operations, that such a map should be used as would render every separate parcel of land capable of certain identification.

I do not think that any map of less scale than three chains to an inch for rural districts, and ten feet per mile for towns, can be used with safety for any of the objects which I have enumerated.

A scale of six inches to a mile would no doubt make a map of considerable utility; but it would be quite inadequate for the purposes I have mentioned, and, therefore, a very imperfect document; and when it is considered that the expense of the field-work, in making an accurate map of six inches to a mile, would be almost as great as for the larger scale of three chains to an inch, it seems a most unwise economy that would, for the sake of a comparatively small saving in the cost of plotting and engraving, prefer an imperfect map, limited to few and comparatively unimportant objects, to a complete plan that should serve all the purposes to which such a document can be applied. I consider the scale of six inches to a mile too large to be useful for general consultation as a road or railway map, and much too small for any purpose affecting the rights and estates of individuals.

I observe that Colonel Dawson recommends 24 inches to a mile for rural districts, and 10 feet to a mile for towns. Whether the scale adopted were 24 inches or $26\frac{2}{3}$ inches to a mile, would make no difference in the value of the map for any purpose that can be contemplated; I mention $26\frac{2}{3}$ inches, because, if published at half that size, the maps would be available for works requiring the consent of Parliament, as the scale would be the same as required by the standing orders of Parliament.

Apart from this consideration, the scale suggested by Colonel Dawson appears to me the best, and probably, on a question of such importance, the standing orders of Parliament might be made to conform to it.

I beg to add one observation with regard to contour levels, which I hold to be practically useless, or at least not to have sufficient use to justify the expense of their adoption.

By an Act of Parliament, 8 & 9 Vict. c. 7, for enclosing the open fields surrounding the town of Nottingham, sec. 103 provided that contour levels should be taken by a surveyor appointed by the Board of Ordnance, for the purpose of assisting the Commissioners to provide for the proper direction, inclination, and situation of roads, drains, sewers, and flood-water ways. These levels were taken with great care and accuracy; lines showing vertical altitudes of 20 feet were marked upon the plan, and extended over the whole area of 1,000 acres. Bench marks were set up, and the height marked on stone posts.

As one of the Commissioners for carrying out this inclosure, I have had ample opportunity of witnessing the practical use and benefit derived from this costly process, and I have no hesitation in saying that nine-tenths of the cost of these levels and contour lines has been thrown away. A very large portion of the newly enclosed lands has since been built upon. Roads have been set out, and the levels of sewers determined; but in no case has it been possible to assign the level of a house, road, or sewer, or to draw any working section for the construction of them, from the contour lines laid upon the map. No sooner had building operations commenced than the surface of the lands was so changed that it was impossible to identify the contour lines upon the ground, and a large proportion of the stone bench marks were removed or destroyed.

The only advantage derived was from the few bench marks set up, which, serving as starting points for taking new levels, saved some trouble in levelling to a more distant datum. But this advantage would have been equally gained by a few level points being in the first instance assigned and marked upon the ground, which might have been done for 20*l.*, whereas the contouring could not have cost less than 300*l.*

If contouring could be of any value it would be in such a case as this, but I hold it would be the highest folly and extravagance to extend such a system of levels over the whole country.

It would be a great advantage and a slight cost to have some level points ascertained and marked upon the public maps, such as the level of rivers, the

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height of hills, and a few prominent objects. Bench marks might also be very advantageously fixed in each parish, say on some part of the parish church; but I think no system of levels for public purposes ought to go beyond this.

On the whole question of public surveys, I entirely concur in the observations of the Hon. F. Charteris and Colonel Dawson, who appear to me to give the truth of the matter, and almost to exhaust it.

No. 91.

MR. A. DOULL, Civil Engineer, South Eastern Railway.

1, Morden Terrace, Greenwich, August 6, 1853.

In reply to your letter of the 2d instant, I beg to submit the following statement:—

For draft plans of rural districts, as public } 24 inches to one statute mile.
records.

This is the smallest scale which will admit of the area of each inclosure, being obtained by scaling the map itself, with sufficient accuracy to serve the purpose of a valuation, or any of the various uses to which a map on a large scale, with the areas of each inclosure, may be applied.

For plans to be engraved for } To be drawn on zinc, and published on the full
sale. } size of the original.

The objects of this proposal are *Security*, *Economy*, and *Utility*.

Security. If there be but one original full-sized drawing, it may be destroyed by fire, or otherwise injured by time; and to be frequently examined and copied would also soon damage an original plan.

Economy. Copper being four times the price of zinc, the expense of copper for the reduced scale of twelve inches, and of zinc for the full size of twenty-four inches to one mile, would be the same.

The expense of drawing the full-sized plan on zinc would be at least as much less than the expense of engraving the reduced plan on copper as would cover the expense of the additional quantity of paper necessary for printing the full-sized map. The whole cost of making the reduction from the scale of twenty-four to that of twelve inches to the mile would consequently be saved, and the errors incident to a reduction avoided.

Utility. With respect to the utility of a published map on a scale of twenty-four inches to a mile, as compared to a map on a scale of twelve inches to a mile, there can hardly be a comparison instituted. It is very true the areas of the several inclosures, as existing when the map was completed, may be obtained from the original map, and inserted, where the spaces will admit of it, on the reduced map. But the great superiority of the large map over the reduction would consist in the facility and accuracy with which the owners and occupiers of land could add subsequent alterations and improvements, or effect a re-division of property, and keep up, at a very trifling expense, a perpetually correct map.

To engrave on copper the ever-changing features of a country in minute detail, and on a scale so small as not to admit of alterations being usefully made upon the plan, is, to say the least of it, a species of folly.

If recourse must be had in all cases of alterations to the original, the object of a published map would be in a great measure defeated.

As, therefore, the engraved reduction would be manifestly the least useful and the most expensive, it can hardly be necessary to accumulate reasons for zincographing the full-sized plan of the rural districts of Scotland, so far at least as cultivation extends.

For draft plans of towns for record - 10 feet, or 120 inches to one statute mile.

For plans of towns to be engraved } To be drawn on zinc, full size, and printed
for sale. } in colour, similar to the enlarged specimen of the Board of Health.

Having entered somewhat into detail upon the first and second heads of inquiry, it will not be necessary to add much by way of special observation.

On carefully reading the papers on Ordnance Maps accompanying your letter, I have been astonished to find that the contest, with respect to scale, has been

continued so long, as the most conclusive evidence of the insufficiency of the six-inch scale is contained in the statements of the advocates for its continuance. Page 1. Colonel Colby, writing to the Inspector-General of Fortifications, says, "It is, therefore, highly desirable that the nature of the survey, which is to be carried over Scotland, should be thoroughly considered and determined during the present year (1840), to prevent the recurrence of such delays and expenses as have operated against both the English and Irish surveys, from the progressive improvements demanded since their commencement." And again (page 2), "The *purposes* for which those surveys (the English and Irish) have been designed, have been *gradually developed*, and the 'cause for regret is, that those purposes had not been all *originally known*."

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These are important admissions, as they show that Colonel Colby was not satisfied with the scales of the maps which he was constructing, as they did not satisfy the progressive requirements of the age. The extended uses to which these maps are applicable are now fully understood, and the scales should be altered accordingly. Page 3. "A cost of time and money has been bestowed upon the English maps which, had the original design been formed on a thorough knowledge of its *future uses*, would have gone far towards the progress of a national map on a larger scale, and fitted to *receive additions*, marking the progress of society from time to time, at a trifling expense."

Had these "*future uses*" been anticipated, the map of England would have been so constructed as to have answered the purposes of the commutation of tithes, parochial assessment, the inclosure of commons, and all similar purposes. It is inconceivable why a six-inch map should be persevered in by the Ordnance, when its inadequacy to answer these purposes is now so well understood.

Page 5. "Having surveyed the townlands and other divisions directed by the Act, these surveys are laid down on content-plots, and their areas are numerically computed from registers taken from the field-books, and are sufficient to compete with surveys laid down on any scale, however large."

This extract proves that the great expense of *content-plots, registers, and numerical computation*, only placed the Ordnance Survey of Ireland on an equality with a large-scale map as regards the aggregate or gross area of townlands, generally averaging two or three hundred acres in extent, leaving the areas of all internal divisions, down to a single acre, to be derived by scaling a map thus declared inadequate to give, with sufficient accuracy, areas of two or three hundred acre-lots. The large-scale map, if adopted, would, according to the above authority, have been sufficient to give the area of all the divisions of property in the country, as accurately as the gross area of townlands is obtained from an elaborate and expensive numerical computation.

In Mr. Griffith's letter, page 28, it is stated that "In making the tenement valuation, I find the six-inch scale sufficient for determining the area of tenements not less than one acre, measuring from paper." In Mr. Griffith's evidence in 1824, he states that ten acres is the smallest subdivision of land which could be laid down with distinctness and accuracy on the six-inch scale.

In Major Larcom's letter, page 27, it is stated that "No one scale can subserve all purposes; but I believe the six-inch serves more than any other as a convenient medium." A convenient medium implies the existence of no other map; but when the one-inch map of Ireland is published, the "convenient medium" will most assuredly be out of place.

Thus it will be perceived that the advocates for the continuance of the six-inch scale afford ample proof of its insufficiency. As the Ordnance Six-inch Survey is said to contain all the detail that would be necessary to be shown upon a scale of the largest size, it is evident that, as far as the field operations are concerned, there can be no additional expense incurred by the adoption of a larger scale.

The mere laying down the work on six inches or twenty-four inches to a mile from the field-notes, is a matter the cost of which may very easily be tested. It is my opinion that the advantage, if any, would be in favour of the larger scale; that is, if strict accuracy is to be kept in view. The additional quantity of paper for the larger scale is an item too trifling to merit attention.

As you do not, in your letter, solicit an opinion upon the most economical and expeditious mode of providing a correct and really useful map of Scotland, I will not enter into that part of the subject, but I beg to enclose you a copy of Three Letters on the Survey of Scotland, published in the "Glasgow Sentinel,"

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and now republished by Stanford, 6, Charing-cross, in which you will find some useful suggestions; and in the latter part of the third letter there is a plan proposed for executing the survey of Scotland, by the combination of civil and military surveyors, which I believe to be the only mode by which a really good map can be produced in a reasonably short time and at a reasonable cost.

Extract from the publication above referred to.

"The mode of operation would be thus:—1st. The Ordnance to revise their primary triangulation and complete their secondary triangulation, bringing the sides of the several triangles down to lengths of from one to two miles, the trigonometrical points being more numerous in the close than in the open country. 2d. To prepare diagrams of these points and distances in convenient portions (say one-third or one-fourth of a county), reduced to meridional or sheet lines, and consequently bounded by straight lines. 3d. The detailed survey of the districts comprehended by these diagrams would then be put up to competition by civil surveyors, not, as a matter of course, giving the work to the lowest bidder, unless some reasonable grounds could be shown that the parties could execute the work. 4th. Every minute detail to be surveyed accurately, and laid down to a scale of twenty-four inches to one mile on rectangular sheets of paper, thirty-six inches by thirty-two inches, which would contain two square miles or 1,280 acres. 5th. To scale the area of each inclosure from the map, and to insert such area in its proper position on the map. 6th. The map so finished, together with the field-books, to be handed over to the Ordnance to be carefully examined (relying principally upon field examinations) previously to granting a certificate for payment. 7th. The enlarged plans to be drawn on plates of zinc, corresponding with the sheets of plan, and published without any alteration of scale. 8th. The Ordnance to reduce the large map to a scale of one inch to a mile, hill-sketch, and publish it. 9th. The Ordnance to run levels across the country in such a manner as to place several well-established *bench-marks* in every square mile of both maps, abandoning contouring as a mere childish mode of wasting public money."

It is almost unnecessary to say that a national survey is one of the public works which ought to be undertaken by the Government of this country, and it would scarcely be credited, in the smallest and most unimproving state on the Continent, that no national survey exists at the present day of a great portion of the United Kingdom of Great Britain.

It frequently happens that in Government undertakings more time is wasted in knowing what to do, and how to do it, than would be necessary to accomplish the work; and, when accomplished, it sometimes happens that the thing produced is not what was intended to be produced, and does not answer all the purposes which, by the exercise of a little foresight, it might have answered. This is pre-eminently the case with respect to the national surveys.

What may, with propriety, be designated the battle of the scales, has now existed for the last twelve or thirteen years. It has not raged with very great fury all that time, it is true, but neither has it made much progress, and the conflicting and, in some respects, extraordinary evidence which has been accumulated (the laboured opinions of some great men suspended upon a few "if's" and "but's"), does not bid fair for a speedy or a very satisfactory conclusion.

The memorable battle of the gauges, in connexion with railways, was fought with far more determination and talent, and consequently exhausted the energies of the respective combatants much sooner, and died away without producing any practical effect.

It is to be hoped, however, that the battle of the scales will result in something more beneficial and more permanent.

Surveys are intended for various purposes, and are consequently executed in various ways, and with different degrees of accuracy. But the most universally useful, and the most permanent map, is one constructed on a small scale, exhibiting the permanent physical features and physical relief of a country, together with such other matters as may be desirable, and which may be easily introduced without injuring the general character of the work.

The Ordnance Map of England and Wales, on the scale of one inch to a mile, is well adapted for all purposes to which a general map can be applied; and as the great leading features of the map are the natural unchanging features of the

country, it is the most permanent map that can be constructed. This map is admirably adapted for the preliminary investigation of any district of country for the purpose of the selection of lines of railway, common roads, canals, water-works, or any public work of magnitude and importance.

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This map, however, as at present published, is much in want of revision; and its value would also be very much enhanced if there were placed upon it five or six well-established "bench-marks" in every square mile. These bench-marks would not only be of incalculable benefit to the engineer, as affording a number of starting points for carrying levels simultaneously over an extensive line of operation; but by being all reduced to the same datum plane throughout the Kingdom, all geological stratification, as exhibited in railway cuttings, tunnels, extensive foundations, the level of springs, and various other useful and interesting phenomena, in connection with public works, could easily be referred to the same datum plane, and thus furnish data for useful and important generalization.

In all preliminary investigations of a country for the development of its various resources, the one-inch map possesses many advantages over the six-inch map. By the former, a greater extent of country is brought under view at one time than by the latter. The one-inch map exhibits the inequalities of surface in an intelligible manner, whilst the six-inch map presents a perplexing maze of contour lines, which, to be of any use, must be studied as a matter of detail, and not resorted to for a general and comprehensive view of an extensive operation.

As the six-inch map scarcely exhibits any natural features of the country, but principally shows a very minute division of property in small inclosures and numerous cottages, or rather huts, of the most temporary construction, any extensive improvement in the agriculture of the country, such as is likely to result in Ireland from the operation of the Encumbered Estates Act, will cause the map, in a few years, to be of little value, particularly as a six-inch basis is too small to admit of alterations being made upon it.

In the selection of the best possible section for a line of railway, various systems of levelling have been adopted, but never, that I am aware of, has the contour system been used.

A very general system of levelling, in connexion with railways, is that of levelling along a straight line, any required length, and also, levelling cross sections at right angles to this line, which cross sections may be continued so as to cover the breadth of country under investigation.

A much better, and a much more expeditious system, is that known as the system of "surface levels." By this mode, levelled points, in connexion with a fixed datum, are placed along all ridges and valleys, leaving the intermediate spaces between these ridges and valleys, where these spaces are perfect planes, without any levels, as the level of any intermediate point can easily be inferred, from the points above and below it, with sufficient accuracy.

Contouring is still more inapplicable to the drainage and improvement of towns, than to railway purposes in the country. Of this fact I had sufficient evidence in the drainage of Windsor, having superintended the levels of the drainage through the Home Park, and the headings which were driven in various directions under the castle.

The map of Windsor was contoured very minutely, and, no doubt, at very great expense; and it is not too much to say that the contour lines upon the map were not worth one farthing for the purposes of the drainage of the grounds and castle.

It being admitted as an indisputable fact that no one map will answer all purposes; that the one-inch shaded map is indispensably necessary; and also, that much of the labour and expense necessary to produce the one-inch map may be made available towards the production of a second map: it necessarily follows, both upon the principle of utility and economy, that a second map shall be produced and constructed upon a scale sufficiently large to answer all the purposes to which the one-inch map is not applicable.

Having surveyed from forty to fifty parishes for the commutation of tithes and parochial assessment, and laid down the work as first-class maps on a scale of three chains to an inch, or $26\frac{2}{3}$ inches to one mile, I found that scale to give the areas of the several inclosures with very great accuracy.

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The accuracy with which a map can be scaled is in the exact proportion of the square of the number of inches to the mile at which the map is constructed.

Thus, with reference to the three scales of twenty-four inch, twelve inch, and six inch, which are multiples of each other: suppose that by the scale of twenty-four inches to a mile the area can be obtained to one perch per acre, that is, to $\frac{1}{160}$ of the area of the map; a space equal to one perch on the twenty-four inch map would, if transferred to the twelve, and the six-inch maps respectively, be four and sixteen perches; consequently the areas on these scales could only be obtained to the $\frac{4}{160}$ and $\frac{16}{160}$, equal to $\frac{1}{40}$ th and $\frac{1}{10}$ th of the size of the map.

In the course of my practice with respect to scaling areas from paper, I have frequently met with persons, not well acquainted with the subject, who attributed all errors and anomalies to the contraction or expansion of the paper.

The contraction and expansion of paper should be allowed for as the index error of an instrument is treated, and not resorted to for the purpose of covering blunders or solving enigmas.

In the event of the adoption of the twenty-four inch scale, I would propose that the work shall be laid down on rectangular sheets of paper, each sheet to contain two square miles. The marginal rectangular lines to be engraved on a plate of copper, with a scale on the outside of each of the marginal lines. One plate would serve for printing off all the sheets necessary for laying down the plan of a county, or as great an extent as would be connected with one meridian line.

The work should be laid down, and the areas computed, with reference to the scales printed on the respective sheets of the map, and no error could then result from the effect of atmospheric change upon the paper.

The correction for contraction or expansion of the paper may easily be made. Let (c) represent the rate per cent. of linear increase or decrease by expansion or contraction, then $(\frac{200c + c^2}{100})$ will be the rate per cent. of the increase or decrease of the area of the rectangle.

To apply this formula to a rectangle containing two square miles, or 1,280 acres, having its sides respectively 120 and $106\frac{2}{3}$ chains in length: Let (c), the rate per cent. of expansion, be equal to 2, (that is, two links per chain in each direction), then $(\frac{200c + c^2}{100}) = 4.04$ will be the rate per cent. of the increase of the area of the rectangle; $1280 \times .0404 = 51.712$ acres; and the area of the whole expanded rectangle will be equal $1280 + 51.712 = 1331.712$ acres.

If (c) had represented the rate per cent. of decrease, the area of the whole contracted rectangle would, by the same process, and using the negative sign, be $1280 - 50.688 = 1229.312$ acres.

The corrections being made for contraction or expansion upon the whole of the inclosures of which the rectangle is composed, according to the above formula, the sum of the corrected areas would be checked by the constant area of the circumscribing rectangle; and thus a direct and efficient test of the accuracy of the areas would be obtained, without an elaborate and expensive arithmetical calculation.

A map on a scale of twenty-four inches to one mile with areas, and a map on a scale of one inch to a mile, but without shading, ought to be produced of any part of Scotland at eightpence per acre, and the mountain districts at fourpence per acre (towns excepted), the Ordnance finding stationery and the trigonometrical distances, either laid down on rectangular sheets, or supplied in a diagram. That is, on the supposition of the work being executed as contract work by civil surveyors.

Should you wish for further information on the subject of this inquiry, I shall be happy to enter fully into every branch of the survey, including levelling, and contouring, and to furnish an estimate of the expense.

No. 92.

MR. W. J. MACQUORN RANKINE, Civil Engineer, F.R.SS., London and Edinburgh.

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scales.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	- 24 in general.
In districts incapable of cultivation	- 6
For plans to be engraved for sale	- 6
For draft plans of towns for record	- 60 in general. (120 in special cases.)
For plans of towns to be engraved for sale	- 60 in general. (120 in special cases.)

SPECIAL OBSERVATIONS.

59, St. Vincent-street, Glasgow, August 9, 1853.

Having attentively read and considered the printed papers transmitted to me along with your circular of the 6th instant, I beg leave respectfully to submit to the Lords Commissioners of Her Majesty's Treasury the system of scales recommended above, for future national surveys; assuming that the results of the Ordnance Survey will, under any circumstances, be separately published on the reduced scale of one inch to a mile, so as to provide a map for geodesic and geological purposes.

In stating the following reasons for preferring the scales above specified, I beg that it may be understood that I refer to their advantages in an engineering point of view only; being those as to which my previous experience and studies best qualify me to form an opinion.

1. *Draft Plans of Rural Districts.*

It is desirable that the draft plans of all rural districts capable of cultivation, to be preserved as public records, should be on a scale such that copies of portions of them may be used in the execution of works.

The smallest scale which can be recommended for this purpose is that of *twenty inches* to one mile; but as even this scale would be found in many instances to be barely large enough, I have proposed that of *twenty-four inches* to one mile, as being sufficient to be used in the execution of works in all ground not occupied by buildings, and as affording considerable advantage as to facility and accuracy in reduction, from the simplicity of its proportion to the scale of six inches to one mile, recommended for the engraved plans.

2. *Engraved Plans of Rural Districts.*

In order to enable an engineer to judge of the capacity of a rural district for the formation of proposed works of improvement, to estimate the cost of such works, to select the best and most economical lines for their execution, and to present to the legislature, the promoters, and the public, the means of comparing the advantages of different schemes, it is necessary that the plans of the district engraved for sale should be on such a scale as to exhibit at one view the largest extent of country, consistently with showing all streams, roads, buildings, and other topographical objects in their natural proportions, and with sufficient precision.

The scale of *six inches* to one mile has been proved, by ample experience in the use of the Ordnance Maps of Ireland for the preliminary planning of railways, water-works, systems of drainage and of river improvements, and other works, to fulfil these conditions exactly; for while it is just large enough to show all topographical details with precision, sufficient for the purpose contemplated, it possesses the advantage of presenting, at one view, a greater extent of country than any larger scale would do.

With respect to the opinions, regarding the advantages of the six-inch scale, as compared with larger scales, which are contained in the printed correspondence, I may state that I concur generally in the views of Major Larcom, Dr. Griffith, Mr. Vignoles, Mr. John Frederick Bateman, and Mr. Philip Park.

Amongst larger scales, that of twelve inches to one mile may be specified as peculiarly disadvantageous, being at once too large for preliminary purposes, and too small for the execution of works.

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I may here be permitted to observe, that it is essential to the utility of plans to be used in the preliminary planning of works, that the levels of the ground should be distinctly marked; and that the best mode of doing this is unquestionably by contour lines. The position of passes across a ridge of hills may be indicated to the engineer by the course of streams; the various levels of those passes may be shown to him by figures; but it is by contour-lines alone that he can be informed, at a glance, whether the access to any particular pass will be direct or circuitous in course, steep or easy in inclination, light or heavy in works,—what extent of country may be rendered available for the supply of a proposed water-work,—what area of land will be flooded by a proposed reservoir, or relieved from floods by a proposed system of drainage, or river improvement.

3. Plans of Towns.

The scale of *sixty inches* to one mile, now employed, is very well adapted, both for the preliminary planning, and for the execution of the works of improvement required in most towns; but in some of the more densely built cities it has already been found insufficient; and for them the scale of *one hundred and twenty inches* to one mile is recommended.

With a view to the laying out of the main lines of general systems of drainage and water supply, (and of streets in large cities,) it is desirable that all towns should be shown in considerable detail on the six-inch maps, as in the Irish Survey.

No. 93.

MR. THOMAS WOOLLCOMBE.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	26 $\frac{2}{3}$
For plans to be engraved for sale (subject to the observations below).	13 $\frac{1}{3}$
For draft plans of towns for record	120
For plans of towns to be engraved for sale	60

SPECIAL OBSERVATIONS.

Devonport, August 15, 1853.

In compliance with the desire expressed in your letter of the 6th instant, I have carefully perused the papers therewith transmitted, in reference to the adoption of a proper scale for the purposes of a national survey.

The only grounds upon which I could venture to give an opinion on this subject are, from having had considerable experience in carrying into effect the provisions of the Act passed in the Eighth Year of Her present Majesty's Reign, for enfranchising the Estates of the Assessionable Tenants of the Duchy of Cornwall.

It was requisite to accompany the claims delivered by the tenants with accurate plans of the several properties, and therein clearly to define their boundaries. In one manor—Tintagel—which came more particularly under my cognizance, I made out myself ninety-three of these claims, and a considerable number of them comprised house property standing on a few perches of ground. In this case, maps, on a scale of six inches to a mile, would have been perfectly useless; and, although it would have been practicable to have used maps of twenty inches to a mile, it was nevertheless found most convenient to resort to the first-class map made for the tithe apportionment, which is on the scale of 26 $\frac{2}{3}$ inches to a mile.

When the Commissioners under the Act of the Eighth Victoria made their award, they accompanied it with a general map published on half the scale of those appended to the claims; and this map, though perhaps small where the accurate identification of boundaries and house property is required, is sufficiently convenient for general purposes.

My experience, in reference to the use of maps on the transfer of landed

property generally, leads me to the same conclusion as that above expressed; and I feel a strong conviction that no measure for the registration of assurances will confer proper benefits on the owners of land, unless a system of maps is made available, by means of a national survey laid down on the scale of the first-class tithe maps, to which the public can have access on fitting occasions.

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With reference to the scale of maps for towns, I do not think they can be made practically useful, unless laid down to the scale of 120 inches, or ten feet to a mile.

I do not apprehend that it would be found desirable in publishing these maps for general use, to make them include large tracts of uncultivated land, such, for instance, as the Forest of Dartmoor. For all practical purposes which I can imagine, it appears to me that the original Ordnance Survey of these districts is large enough.

I feel some difficulty in giving an opinion as to the precise scale of reduction on which the maps for publication should be prepared.

Half of the scale on which the first-class tithe maps are constructed, or $13\frac{1}{2}$ inches to a mile, being the scale required by the Standing Orders of Parliament for depositing plans of railways and canals, may be found generally serviceable for that and other purposes.

No. 94.

MR. PHILIP PARK.

Preston, August 20, 1853.

After having carefully read the correspondence and remarks included in the paper accompanying your letter to me of the 6th instant, relative to the scales to be adopted in future for the Ordnance Maps, I have the honour, in compliance with the request of the Lords Commissioners of Her Majesty's Treasury, to state (for their information) my opinions as follows:—

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	6
For draft plans of towns for record	-	-	10 feet
For plans of towns to be engraved for sale	-	-	5

SPECIAL OBSERVATIONS.

In my letter to you of the 14th March last, I stated as my opinion, on the relative merits of a six-inch scale to a mile or a twelve-inch scale for national purposes, that it would not be desirable to adopt the twelve-inch scale for publication; to this opinion I still adhere. The six-inch scale would subserve most purposes to which a twelve-inch map could be applied; the twelve-inch map would be too large for general use, and too small to scale off the acreage quantities of small inclosures, where detailed measurements are required.

But as a document to be preserved as a public record, from which minute measurements and areas of fields might be obtained, a much larger scale is necessary. I have mentioned a scale of twenty-four inches to the mile, or three chains to the inch, as sufficiently large for all purposes; the extra cost of making the necessary surveys, and plotting the plan upon this scale instead of the six-inch scale, including the cost of reducing the scale for the maps to be published, would be comparatively small, and the value of the documents much enhanced.

I prefer the scale of twenty-four inches to the mile rather than four chains to the inch, as recommended by Mr. Vignoles (No. 8), for the reasons stated in Lieut.-Colonel Dawson's Letter (No. 6) to the Hon. F. Charteris.

For maps of towns, I think the *manuscript* plan should be ten feet to the mile. In tunnelling and other underground works, where very great accuracy is necessary, a scale of five feet to the mile is too small, though this scale I should still recommend as quite large enough for publication.

PROFESSOR SMYTH, F.R.S., L. & E., Astronomer Royal of Scotland.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	240
For plans of towns to be engraved for sale:			
For first-class towns	-	-	120
For second-class towns	-	-	60

SPECIAL OBSERVATIONS.

If, as appears is to be the case, a map be engraved on the scale of one-inch to the mile, to engrave another of a size so little different as six inches to the mile seems unadvisable; for more than usual care in using the smaller one, magnifying glasses, &c., would so very nearly enable a person to get the same results from it as from the slightly larger one; and six inches to a mile is not large enough for some statistical and fiscal purposes; twelve inches to a mile appears, therefore, a better scale for the second engraved map.

For much the same reasons, as well as from the actual experience of sanitary and engineering operations, the next step in the scale (for towns) would be more properly 120 inches to a mile, rather than the sixty inches hitherto in use. But, inasmuch as the expense of engraved surface must be so large in the former case, and as under the general name of towns there are so many gradations in size and intrinsic value of ground per foot, some separation between straggling agricultural towns and condensed manufacturing cities, would appear desirable.

Royal Observatory, Edinburgh, August 16, 1853.

I have received your letter of the 6th instant, have carefully read the enclosure on the "Ordnance Maps," and subjoin, as you desire, in the printed form, my opinions of the most desirable scales for the future national surveys.

The full and clear manner in which you have stated this extensive and important question, has enabled me to come speedily to a definite conclusion; and the result will doubtless be the same through this country at large. Seeming contradictions will be explained by the narrowness of former premises, and the universal wish will be manifested for the *largest* scale, for that which will satisfy *every* purpose, civil, military, and scientific.

When the matter was first prominently brought before the Royal Society and Edinburgh generally, a few years since, the question was made to appear one simply of scales—one inch versus six inch—either one or other; and it was pretended by some that the six-inch was utterly useless, and that by reason of its largeness; that it could not be trustworthily reduced from, on account of expansion and contraction in the paper; that it was safer to enlarge from a small map than reduce from a larger one, &c.

To such inverted assertions of common sense and daily experience, of course all sensible men were opposed; and their opinions developed themselves in the numerous petitions which have since been sent to Parliament in favour of the six-inch scale.

But there is no superstitious reverence for six rather than any other and larger number of inches, no natural reason has been given for it, no social prejudice suspected. It was merely, that of two numbers which were alone given to choose between, six was better than one; and for the same reason now, twelve will be considered better than six. The petitions for the six-inch scale were essentially petitions for a *large* map, the largest that there appeared any chance of obtaining, and accurate enough, it was hoped, to prove a useful foundation for *all* inquiries: this sort of map against a small and inefficient one, whose data would be so uncertain, that fresh surveys would ever have to be continually instituted for particular purposes, and the country would always be obliged to support a large profession of landsurveyors, agents, and lawyers.

The many occasions in Ireland in which, in presence of six-inch maps, small holdings had to be remeasured on the ground; and the several places in England,

where, with the same maps, new surveys have been instituted on the scale of twenty-four inches to a mile, sufficiently prove that however powerful the six-inch may be above smaller scales, it is not all that the country requires now. Twelve inches to the mile, however, for the *engraved* maps would, I think, be sufficient, for, owing to the great refinement of the Ordnance work on copper, as much accuracy could be obtained from it on that size as from ordinary manuscript maps of double the size, or twenty-four inches to the mile, and that seems almost the largest scale ever required for country surveys.

These actual experiences above alluded to of persons in the Board of Public Works in Ireland, and in the Tithe Commission in England,—these efforts that they were obliged to make, for the sake of the strict discharge of their duty, to break through the limits of the scale of the Government survey, to abandon the many conveniences of a work performed ready to their hand, and measure the ground again on a much larger scale, appear to me the most valuable of all the testimonies that can be appealed to in arranging the plans for the future maps of the country.

There is always much convenience in following, if possible, an existing and extensively received scale; men gradually adapt themselves to its use, confine themselves within its bounds, and cease to think in an independent and impartial manner: thus prejudice in favour of the established scale arises, and bars further improvement. Now professional men being precisely those who are exposed to this natural action of the circumstances of the case, I am far from joining in the complaint that appears to have been raised, to the effect that the Parliamentary Committee was not sufficiently professional: on the contrary, it appears to have been excellently composed for the purpose in view; for its many unprofessional members must have been untainted by prejudice in favour of some particular routine, which constant practice might render very seductive. Indeed a far more neutral and impartial opinion of the applicability of several scales to the purposes of the country can be given by educated men, extensively acquainted with the requirements of the nation, and not much more conversant with any one than another of the several scales.

Moreover the requirements of the country are so continually enlarging, that it is only due wisdom in Government, and no censure on the intelligent officers employed, to pause in their course, and inquire, if what they are doing is still satisfactory to an advancing people. When we find the Ordnance Survey was first prosecuted as an exercise to teach young officers ground-sketching, and was then taken up by country gentlemen to furnish them with a hunting map; that its next step was procured by the necessities of agricultural draining; that gas-lighting and railroad locomotion have originated since then, and a vast increase of all manufacturing, mining, and commercial operations have taken place, it can evidently be no blame to those employed in making the survey, if the one-inch scale on which they began, has long since been increased to a six-inch, and that again is about to be expanded to a twelve or twenty-four inch. The wonder would rather have been if they had been prophets enough to have fully foreseen the progress of the nation in each and all its various branches of industry.

The safest plan by which Government can meet these growing wants would appear to be, by engraving the *largest*-sized map, though in but a skeleton shape; for then whatever was once entered there, would stand good for ever: nothing would have to be altered; nothing would be found *wrong*, as is so often the case when a large scale is brought to bear on an old one of a small scale: *additions* of detail would alone have to be made, and those could be made easily for, and even by, the particular parties interested.

With this view I should advocate the engraved map of the country to be on the scale at once of twenty-four inches to a mile, but that economy of public money seems to require that the intermediate scale of twelve inches to a mile should first be *proved* in practice to be too small.

In either case, an objection which was applied to the six-inch scale, as mentioned in your printed enclosure, has to be met; for if true of the six inch, it would apply with still greater force to the twelve and twenty-four inch. It was said that the map of Scotland on the six-inch scale would be 216 feet long by 126 broad, and therefore too large to be exhibited and understood at one glance; that it was impracticable, unwieldy, impossible, &c. This is about as wilful and perverse a mode of stating the case or using the map as if a man were to insist on one of the longest works of any author being printed in one continuous

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sheet, like the old Hebrew roll; and was then to object to a large size of type, because he could not see the whole contents at once and comfortably at one look, and because the size of the sheet was too large for any ordinary room, and its use in the open air was rendered very inconvenient by the wind.

But, as every one knows, modern improvements have led to the subdivision of the ancient roll into leaves of moderate size, and these are bound in a volume with a title page, a table of contents, and an index. The work is then portable, and any reading man can refer to anything he wants in a moment; but no reading man requires to see the whole writing of the book at once; sufficient if he can see one page at a time, and remember what was on the preceding ones.

Similarly with the map, it is not published in the hundreds-of-feet-long sheet, and no one wants it in that shape. On the contrary, it is separated into leaves of moderate folio size, each numbered, and these may be bound in volumes, with, in place of a title page, an index map of the whole country; in place of a table of contents, index maps of each county; and in place of the index of the printed book, index maps of portions of counties. By these several gradations of index maps, not only will a good general idea of the country be obtained at a cursory inspection, but reference can be instantly made to the particular sheet of the six, or twelve, or twenty-four inch maps, when further details of any spot are desired.

Whichever of the scales be adopted, it is only to be extended, if I understand rightly, to "cultivated" ground; and there will always be doubts, near the boundaries, as to what shall constitute the claim of cultivated ground, and entitle it to the large map. This pregnant source of complaint should be settled in limine.

Some consider *arable* land to be the so-called "cultivated;" and *pasture* ground as the noncultivated. But that can hardly be a just definition, as it excludes the valuable grazing fields about the metropolis, and ignores all the most precious improvements of modern farming, all the guano-grown and liquid-manure-forced grass of Tiptree Hall, and, in fact, the whole aim and tendency of the present, as indicating the course of future, British husbandry.

Again, some dwell on *enclosed* and *unenclosed* land; but in that case might be included under the former title some of the most barren hills of the Highlands, across which, for miles and miles, walls of the indigenous stones have been piled, as well as savage and extensive glens and valleys which even the stray tourist is prevented from entering.

But a rule capable of meeting every case appears to be, the value of the soil—the rent it will bring. When the rent rises above a certain sum in a tract of at least a given dimension, let that place be considered entitled to the large survey—entitled too to *claim* it whenever such a return can be shown. This is a vital principle; for if a few great officials be empowered to settle now, once for all, what is to be done for each and every part of the country, great injustice may be done by the alteration of circumstances with the progress of time. Nay, this would be the same system as that which produced the rotten corruption of Old Sarum, and made Manchester at last a threatening political volcano. For, in course of time, in the present age even rapidly, one part of the country loses in population and wealth, while another gains. But that which gains, gain it never so much, has had the doom of the small survey pronounced against it long since, and political agitation to a degree dangerous to the nation is the only mode by which the re-opening of the gates of justice can be procured.

But if the principle be once established, that, as soon as any district has so far improved itself as to be able to show the required rise in value of the soil it may immediately claim corresponding privileges, there is then given a powerful incitement to honest industrial occupation, and an inducement to look to that alone as the only practical method of advancing in social rights. For example we need only look to the institutions of the United States, which, starting from a true principle, rendering them capable of growing with the growth, and of adapting themselves to the altering circumstances of the people, completely remove all necessity for political agitation; they require no tinkering from time to time by the party in power to make them continue to hold together; but survive with all their youthful elasticity merely from the simple principle of giving the rights of a State to any territory that can show it has the population of a State.

My general opinion then, Sir, in answer to your question as to the scale for the engraved maps of the future survey of the country, is, that it should not be less than twelve inches to a mile.

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This will undoubtedly cost much more than one on a far smaller scale, and when the difference of rates for a large extent of country is added up, it amounts to a sum large enough to dazzle the eyes of all who are worthily anxious to economize the means of the country. But for that very cause's sake, let them beware how they adopt too small a scale. For, if the Government map may be found in practice too small, the people will in various ways, by various means and in untoward ways, contrive to make for themselves a better one, large enough for its purposes, though in separate and ill-agreeing sections. That is to say, if the Government map be too small, a larger one will be made; but, as has been proved by the whole surveying experience of the last fifty years, such a map will be made more expensively and less accurately by the ill-agreeing efforts of the people, who on such a work will be acting at a disadvantage, than by the uniform methods of the Imperial Government. In either case, the cost falls upon the people at last, who will thus not only have to pay more for the larger survey made by themselves, but they will have to pay for the whole of that in *addition* to the cost of the former small Government survey, the money for which will then prove to have been needlessly squandered; for if the large map had been first executed, any number of small ones might have been prepared from it, without re-examination of the ground itself.

Thus far I have only spoken of the surveys of the country as distinguished from those of the towns, which I cannot consider so necessary to be performed by Her Majesty's Government. There is so little community of interest and pursuits, and so little correspondence of feeling between different parts of the country, and they are happily so unused to any method of acting connectedly except through the Imperial Government, that it is that Government alone which can carry on a uniform survey from one end of the country to the other, and uniformity is absolutely necessary there.

But with the towns the case is far different, for there is no more occasion that the survey of one town shall be uniform with that of another than that of England with France. The purposes for which the survey of one town is wanted are totally distinct and different from those of another; they are essentially local and confined. Moreover, all the inhabitants of any and every town are well accustomed to act together under their municipal organizations, which are to the towns what the Imperial Government is to the country. The wants of towns too are of a far more varied and complicated character, and there are amongst them greater differences in size, occupation, wealth, &c., than in districts of the country. Only local men can have a thorough knowledge of all these wants, and certainly, if different scales be already thought necessary for rich and poor parts of the *country*, there should be a more extended scale of scales for the several orders of *towns*.

Under such circumstances, all that the Government seems called on to do, is to publish, from the books of the Ordnance skeleton survey, the distances of fiducial points in every town; as, from steeple to steeple; for these would form invaluable base lines to the local surveys. Working down from these, and filling in upon them the streets and the houses, and the door steps, they would be effectually using the same standard of length as the Ordnance, which is the only uniformity required in the surveys of different towns; while, as to the particular scale, size of sheet, mode of engraving, &c., each town might be at perfect liberty to please itself.*

Were this plan followed, there would be unlocked a great part of the Ordnance surveyors, ready at once to be put upon the map of the country, which might in that way be more speedily completed, a consummation so devoutly to be wished.

C. PIAZZI SMYTH.

* As an example of the difficulty of pleasing all towns by one and the same scale, and their readiness, as well as ability, to cater for themselves, I may mention, that the Ordnance Surveyors, after their recent measurement of Edinburgh for their usual five-feet scale, were almost immediately followed by the measurements of town surveyors for a map of more than double those dimensions for sanitary purposes.

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No. 96.

MR. JAMES JERWOOD, Barrister-at-Law.

RECOMMENDED.

Inches to a mile.

For draft plans of rural districts, as public records

For plans to be engraved for sale -

For draft plans of towns for record -

For plans of towns to be engraved for sale

SPECIAL OBSERVATIONS.

9, Dix's Field, Exeter, August 24, 1853.

Your letter of the 19th instant, and the papers respecting the Ordnance Maps, came here on the 20th. Upon their contents, in accordance with your request, I beg to offer the following observations.

The Ordnance Maps of one inch to a mile are of great utility for various purposes, and may be made available for many others. As, however, under any circumstances, maps of the whole country on this scale will be published, no discussion is now requisite to point out the public benefits that will result from their completion and publication.

The main question to be answered appears to be, whether a map of the country constructed on a scale of six inches to the mile, or one laid down on a larger scale, would be the more generally serviceable to the community. Hence, the numerous purposes which require plans of townships or maps of districts must be taken into account, and also which kind of map could be made available in the greater number of those civil purposes.

According to Mr. Driver's statement, published in the first volume of the Statistical Journal; and since in Mr. Porter's Progress of the Nation, England and Wales contain 37,094,400 acres, of which 28,749,000 acres are cultivated, 3,984,000 acres are uncultivated, and 4,361,400 acres unprofitable.

It would be incurring a useless expense to lay down the latter portion on a large scale; the Ordnance Map of one inch to the mile, showing the exact position of all the principal lines and points, would answer every scientific and civil purpose, even should those unhopeful districts hereafter prove sources of wealth by their mineral and other productions.

There is a large quantity of the land comprised under the above denomination of "uncultivated," which admits of improvement, and very probably would repay the necessary outlay to effect it. Large tracts on Dartmoor have been cultivated, and there are extensive ones still remaining which appear to be equally encouraging. Every man who makes two blades of grass grow where only one grew before, is a benefactor to his country. There is a vast scope in many parts of England and Wales (I would particularly mention Radnorshire) for the exercise of this most praiseworthy philanthropy, which might, it is thought, be carried into operation very extensively at a remunerating cost. The subject, no doubt, will claim the attention of the Legislature, especially as there must be labour found for a greater number of convicts, and as the experiment on Dartmoor appears to have been highly satisfactory. But although a large portion of the land above termed "uncultivated" may, in the course of time, be converted into cultivated, at present, the common Ordnance map of one inch to the mile would seem to be all that is requisite. Very likely the prominent objects and lines that would be delineated would be more numerous than in the wilder districts, and thus afford facility for divisions should they become necessary.

But, with regard to that large portion of land termed cultivated, it may be observed, that however accurately the principal points and main lines are drawn on maps of only one-inch to the mile, small inclosures of land cannot be represented on them; the mere tracing would occupy more space than legitimately belongs to such inclosures: for this reason a township of no inconsiderable extent and importance is indicated on such maps by its name, and an outline which scarcely affords any notion of its form or boundary; the representing any tenement or garden-plot on a map of this description is quite out of the question. For all purposes requiring such minute information, and also affording a test that such information is correct, maps on this small scale are altogether useless. With very little qualification, the same remarks apply

to maps constructed on a scale of only six inches to the mile. Undoubtedly such maps can be made accurately to exhibit a much larger number of parcels of land than can be shown on a map of one inch to the mile; but houses and small plots could not be made discernible to common eyes, and therefore for many civil requirements this map would be as unavailable as the smaller one.

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It will hardly be disputed that a map constructed on a sufficiently large scale may be made to exhibit all the objects that can be shown on a small one, besides marking with proper accuracy and due limits, tenements and inclosures which, by their minuteness, are excluded from the small map. But if a large parish or district were mapped on the scale that must be adopted to show the buildings of a township, its unwieldiness would greatly counteract its utility. Hence it seems to me that I shall come nearest to a satisfactory answer to the question submitted to me, if I can point out a map on the smallest scale which will accurately exhibit all the matters usually required on maps, except the buildings in townships. In my opinion, maps made on a scale of six chains lineally to an inch, or $13\frac{1}{2}$ inches to the mile, would almost completely effect that object; that is the scale adopted by the Great Western and other railways, and might be made available for every purpose as far as I can see, except for the Health of Towns Inquiries.

To show the buildings of a township and their subdivisions, so that they can be satisfactorily tested, the map must not be on a scale less than ten feet to the mile.

Any district can be laid down more easily on a large scale than on a small one; the question of expense therefore chiefly depends on the material on which the map is delineated, and would be increased in proportion to the superface of the map on the larger scale to that of the map on the smaller one.

Whatever scale be ultimately adopted, it should be nationally uniform, so that all parts of the country may be equally benefited by it. The map constructed at the *public expense* ought to be as generally serviceable as it can be rendered. If the map resulting from the national survey can be made serviceable in one part of the country for civil purposes, every other part is entitled to the same privilege if it be called upon to exercise it. For instance, it would not be equitable or just, if a map constructed at the public expense could be used by a certain district for various civil purposes, whereas another district, which had to accomplish similar purposes, had to incur the extra expense of having maps constructed. In considering, therefore, the question of maps resulting from the national survey, I have not distinguished between the northern counties and the southern ones; if the one have useful maps made at the public cost so ought the other. If maps have been made which are found to be inapplicable to many civil purposes, and it be deemed judicious to improve the system, the defective parts should be retouched and assimilated to the more correct ones, so that uniformity in advantage as well as equality in defraying the expense may be general throughout the country.

Although it is considered that a public map constructed on a scale sufficiently large to *admit* of laying down small enclosures would be highly beneficial to the community, it may nevertheless be questionable how far it would be useful actually to exhibit them in a national map. The reasons for the doubt are, that great alterations are continually taking place with respect to inclosures, especially in a neighbourhood like this, where they are small and the fences of considerable width, abounding with trees. A surveyor of great experience has recently told me that he had occasion to look over some portion of Lord Poltimore's land in this district, twice within a short period; in the interim upwards of fifty hedges had been taken down, so that the map which showed the land at his first visit was nearly useless at his second. A considerable landowner in another district employs men continually in taking down hedges, and where necessary erecting wall-fences instead. One of the leading features in agricultural improvement has been the removal of useless hedges, and letting in the sunshine which trees and bushes shut out. I mention the matter, however, to show that it is not necessary that the constructors of a public map should trouble themselves with laying down very small enclosures: when the boundaries of a parish or district and all the principal lines and features are laid down on a *sufficiently large* scale, such map can easily be filled up whenever circumstances require it. The Tithe Commutation measure fostered a number of surveyors, who at last thoroughly understood their profession. As

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several hundred maps came under my notice during the eight years that I was engaged in this commission, I may observe that the cost of first-class maps became very much diminished during the progress of the measure. At first they were generally at the cost of 1s. and upwards per acre, and at last some were made at 6d., and I met with some at even less cost per acre. In a first-class map every inclosure had a number, which was also in a reference-book showing its content. Before Colonel Dawson would sanction a map of this kind, I believe each enclosure had to stand a testing by the scale, and all the principal lines to be measured by his own surveyors. There is a large number of these maps that might, and should, be made serviceable in a general survey.

There is another point, though rather beside the question submitted, to which I trust I may be pardoned for briefly adverting; I mean the desirability of making the national survey elucidate and accomplish as many scientific matters as can possibly be made compatible with its main object.

In a maritime country like this, it is of the highest importance that the latitudes and longitudes of points on the coasts and other parts should be accurately fixed: when this happens to be the case at the Port from which a ship starts, one end of its course is a known point, an object of no small consequence to the sailor.

The longitudes of places in England given in almost all treatises are taken from the Trigonometrical Survey. Dr. Tiarks in 1822 and 1823 was engaged by the Board of Longitude to determine the difference of longitude between the island of Madeira and Falmouth, and also the differences of longitude between Falmouth and Portsmouth, and Falmouth and Dover. The Doctor published an account of the proceedings to determine these points in the *Philosophical Transactions* for 1824. He has also published a Report of his Chronometrical Observations which may be had at Mr. Murray's. The result of these observations, with regard to the English stations, was that the longitude of Falmouth is four seconds in time greater than it is laid down in the Trigonometrical Survey. It was also ascertained that the longitude of each of the other places as determined by the chronometers was greater in about the same proportion than those given by the survey. The Doctor says, "We may therefore safely infer that it is a general and proportionate defect of all longitudes deduced from the survey, and not the erroneous longitude of any station which has caused the disagreement between the results of the chronometers and the survey. Supposing the final result determined by the chronometers to be correct, the increase of the longitude of the survey = $25', 23'' \cdot 5$ is $4'' \cdot 92$, and at this rate all the longitudes contained in the account of the survey must be increased.

"Dr. Tiarks having satisfied himself that there are errors in the longitudes of places in the survey, next enters into an investigation of the cause of mistake, and he arrives at the conclusion that the longitudes laid down in the survey will deviate from the truth in the same proportion in which the parallels on a spheroid having the degree of the meridian in latitude $51^\circ 41'$ differ from those of the terrestrial spheroid the compression of which is nearly $\frac{1}{316}$."

The longitude of the Cambridge Observatory was determined by chronometrical observations in 1827 by the Astronomer Royal, then the Plumian Professor of Astronomy at Cambridge. He published an account of the process in the *Cambridge Philosophical Transactions*, vol. iii. The longitude of the Cambridge Observatory was found to be $23'' \cdot 54$ East of Greenwich. The longitude deduced geodetically was $24'' \cdot 6$ East, differing by $1'' \cdot 06$ or $16''$ in space from that determined by the chronometers, which would imply an error of 300 yards.

The Astronomer Royal ascribed this difference to some peculiarity in the earth's figure. Dr. Tiarks has come to the conclusion that longitudes determined by the Trigonometrical Survey require correction. But it should be observed that the Doctor concludes that longitudes in the survey are less than those found by chronometrical observations, whereas the Astronomer Royal has made the difference the other way: at present the Cambridge case appears to disprove the law enunciated by Dr. Tiarks.

The principal towns in England are now connected by the electric telegraph, and for scientific purposes they are all under the able guidance of the Astronomer Royal. The difference of longitude between almost any point and Greenwich can be expeditiously ascertained. It is to be hoped that this most important

circumstance will be made serviceable in every possible way in the national survey so as to determine with the greatest exactness the latitudes and longitudes of places, and also to clear up the practical obscurities above named. It is a question of great interest how nearly the longitudes of places determined geodetically can be made to agree with those ascertained by chronometrical observations, and if the longitudes cannot be made to agree, the reason why they differ is matter not less interesting.

I may add that I have taken some of the above remarks from an article "On finding the Longitude of Places, and on the Application of the Electric Telegraph to determine it," which I published some time ago in the "Mechanic's Magazine."

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No. 97.

MR. JAMES FORSYTH.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	24
For plans to be engraved for sale - - -	12
For draft plans of towns for record - - -	120
For plans of towns to be engraved for sale - - -	60

SPECIAL OBSERVATIONS.

Dunach, near Oban, August 25, 1853.

I quite agree with Mr. Vignoles, "that a national survey, executed at general expense, should be on a scale sufficient for all present and all probable future purposes, public and private." In regard to Scotland, the purposes which such a survey would subserve, besides those of a naval, military, and parliamentary character, would be the facilitating of an improved system of general and local taxation; the collection of agricultural statistics; the execution of railways and public roads; the transfer of property, and an improved registration of titles; the decision of boundary disputes; drainage, inclosure, management of estates, and, generally, all the objects of estate maps. The smallest scale which would seem to answer all these purposes is that of 24 inches to the mile; and as the cost of reduction is comparatively small, and the first cost of an enlarged scale far from commensurate with its enlargement, it would be better to adopt it at once for the measurements and draft plans. I am also of opinion that the whole country should be laid down on the same scale, and that the distinction between cultivated *districts* and uncultivated ones, advocated by some, is objectionable in principle, and could not be practically carried out without much injustice or great additional expense. If it be assumed arbitrarily that certain counties of Scotland are cultivated, and certain others uncultivated, then injustice will be done, but some portion of the expense of the survey may be saved. Again, if all cultivated *fields* are to be laid down on one scale, and all uncultivated land on another, a measure of equal justice will be meted out to all parts of the country (although little encouragement will be held out to improvement), but vast additional expense will be incurred in the survey. But if it be attempted to define what are cultivated *districts* and what are not, what is the quantum of cultivation that is to be the standard? There are very few large portions of Scotland that are without some amount of cultivation; and I think that in practice it would be found, judging from the experience of the Ordnance Surveyors in Ireland (see Major Larcom's statement, page 28), that it would be less expensive "to sweep over even many square miles of bog and waste land, with the great machinery, in common with the rest of the country," than to survey and draw them separately. As the expense of the triangulation, which embraces the whole country, seems to have been already incurred, surely the wiser plan would be to make the survey a general one, on the same scale, but to diminish the amount of detail as to hill and mountainous pastures, laying down only a sufficient number of definite objects to serve for future reference, if required, as recommended by Colonel Colby, and thus save much of the expense. Indeed, it is a strong argument in favour of a survey of the hill districts on the same scale as the general country, that it can be done at less expense, comparatively, on account of the fewer details required, while many of the purposes to be subserved are the same. But I maintain that on grounds of

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general public policy the survey of the hill districts on a sufficiently large scale should be proceeded with, because it will be a help and encouragement to the improvement of the land. I am of opinion that there is no district in Scotland in which the cultivation of green crops and sown grasses for stock would not be profitable, if judiciously carried out; and, moreover, that cultivation to this extent on pastoral farms is absolutely essential to the prosperity of the West Highland districts in particular. The only prospect that I see for the preservation of the native race in their own country is the introduction among them of resident, intelligent, and improving lowland tenants, who will give employment, promote habits of industry, and by degrees raise the standard of cultivation in that part of the country. With a view to this, everything that Government can do to promote the improvement of the land should be done.

No. 98.

MR. LEWIS D. B. GORDON, C. E., Regius Professor of Civil Engineering and Mechanics in the University of Glasgow.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records	24
For plans to be engraved for sale	12
For draft plans of towns for record	120
For plans of towns to be engraved for sale	60

SPECIAL OBSERVATIONS.

24, Abingdon Street, Westminster, August 1853.

What is required by the existing circumstances of the country is manifestly a map or plan of the lands of Scotland on so large a scale that the map may be relied upon for computations to be made from measurements on the plan itself, and such, too, as will admit of subsequent alterations and improvements in the face of the country being transferred to the map with precision.

I am clearly of opinion that the smallest scale that can be adopted for these requirements is that of 24 inches to a mile for the draft plans of rural districts, to be preserved as public records easily accessible to the public; and of 120 inches to a mile for the draft plans of towns.

These scales will be found sufficient for all ascertained practical purposes. From these drafts, plans to a scale of 12 inches to a mile of all districts under cultivation should be reduced and published; the other uninclosed higher districts of the country being reduced and published only on the one-inch scale. The town surveys should be published on the scale of 60 inches to the mile, save in special cases where the 10-foot scale may be called for, as Glasgow and Edinburgh.

In considering the purposes which a national survey should subserve, in reference to the scales to which it should be plotted for record and engraved for sale, the following remarks have occurred to me as proper to be noted:—

1. *Sanitary Purposes.*

Experience has proved that for planning and recording the details of the house drains and main sewers of towns and their suburbs, the scale of 60 inches to a mile is often inconveniently small, and absolutely insufficient in the case of large towns, where the buildings are in dense masses over considerable areas. It requires plans on a scale of 120 inches to a mile to allow of the accurate insertion of new buildings, street improvements, new roads, &c., made from time to time.

For planning the drainage of bogs, fens, and lowlands, the scale of an inch to three chains, or $26\frac{2}{3}$ inches to a mile, is found to be sufficient in general practice; and this scale may be assumed to be sufficient for sanitary operations on such subjects.

2. *Division of Commonly.*

This step towards the final division of waste lands requires the common to be surveyed and plotted to a scale sufficiently large to admit of subsequent alterations and improvements being transferred to the map, and of accurate admeasurements for valuation and division being made on the map itself. Therefore a scale of 24 inches to the mile will be requisite for that purpose.

3. *Registration and Transfer of Property by Sale, Infeudation and Lease.—Management of Estates.—Agricultural Statistics.*

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If the plans of the country be made to a scale sufficient to answer these purposes they will answer every other purpose, and “bring their benefit home to every man’s door.” The scale of the original plot should not be less than an inch to three or four chains, for on a less scale accurate admeasurement for the purposes of subdivision, valuation, &c., &c., on the plan itself cannot be made; though all preliminary investigation might be done to a scale of an inch to six chains, or 12 inches to a mile.

4. *Fiscal Purposes, such as Assessment of Rates, Parochial, County, Estate, &c.*

The scale in this case must be sufficient to admit of the areas of all fields and inclosures, tenements or parcels of land, being ascertained by admeasurement on the map or plan; also to admit of the insertion of reference numbers on each portion described in the book of reference, in which the measurements and valuation for rating purposes are recorded. The scale of an inch to six chains, or 12 inches to the mile, admits of the insertion of reference numbers for portions as small as half an acre; but where the subdivisions of property are very small, the scale of an inch to three or four chains (that is, 24 inches to the mile) would be requisite.

5. *Appropriation by Act of Parliament for Public Works, Roads and Railways, Canals and River Improvements, Harbours and Docks, Drainage.*

The minimum scale on which the plans referred to in private bills for any public work have to be prepared for Parliament is four inches to the mile; but all buildings, gardens, and such property have to be represented in supplemental enlargements to a scale of not less than 400 feet to an inch, or $13\frac{1}{5}$ inches to a mile. The system of supplemental enlargements is inconvenient, and recourse to it is generally avoided.

Great expense is incurred in the maps used for these works, and they are seldom satisfactory when done; and the national survey ought to be plotted to a scale available for these purposes. For although the expense of the surveys appears to come from private sources, yet it is evident that ultimately the whole expense falls upon the nation.

Experience proves that a less scale than an inch to six chains is quite insufficient for the accuracy required in plans for any engineering use. The working plans for canals, railways, roads, &c., inasmuch as their main object has reference to the purchase and transfer of minute portions of property required for the site of the works, are made on scales of from two to five chains to the inch, according as the district is populous, highly cultivated, or otherwise.

A perfectly accurate plan to a scale of 24 inches to a mile would answer all these purposes.

6. *Scientific Purposes.—Geography.—Topography.—Geology and Mineral Statistics.*

In reference to geography, general or special, the scale need not be larger than will admit of an accurate delineation of the outline, river systems, and orography of the country. Five, ten, or even twenty miles to the inch is a large enough scale for this purpose, if the map be a reduction of a well-constructed CONTOURED plan of the country plotted to a large scale.

When detailed local *topography* for public or historical objects is required, the larger the scale of the map the better. Less than 24 inches to the mile would be insufficient for the accurate delineation of details.

For the geological survey of districts in which there are minute geological features to be investigated and mapped, the small scale of the English survey has been, I am informed, found very perplexing and discouraging to the accurate geologist.

In Saxony and France I know that copies of the original plots of the “cadaastre” are used for the geological survey and the manuscript record of the observations and facts.

The large scale of the Irish survey has enabled the Directors of the Irish Geological Survey to lay down the boundaries of formations and to insert much minute but important geological information with perfect precision; while in the English Geological Survey, made under the disadvantage of working with the one-inch scale map, minute features have to be exaggerated or omitted on the

published documents. It is often those very districts that present a complicated geological structure which are of economical importance.

The possession of accurate large scale ($\frac{1}{80000}$) contoured maps will be invaluable to the geologist and to his science in exploring and recording his observations in those districts especially which are the fields of economic geology and subjects for mineral statistics.

7. *General Purposes.—Travelling Map.—Engineering Exploration.—Education.*

The expression "map for general purposes" occurs frequently in the "correspondence, &c. respecting the adoption of the six-inch scale in 1840, and respecting the relative advantages of that scale and a still larger one."

Supposing these to be the "general purposes" alluded to,—

As a travelling map, the Ordnance one-inch map is inconveniently large. Stieler's celebrated travelling map of Central Europe—the most beautiful geographical delineation hitherto produced—is on a scale of $\frac{1}{800,000}$ of nature, or about one inch to $12\frac{1}{2}$ miles, is a perfect travelling map,—a perfect index or gazetteer map; and having been compiled from maps mostly contoured, represents with wonderful fidelity the physical features of the country.

As an engineer's exploration map, the one-inch Ordnance map is certainly most valuable. It is the best map we have, and is very good; but it falls far short of what is desirable, and of what the national survey, accurately contoured and engraved on a 12-inch scale would be.

The one-inch Ordnance Survey is, I understand, to be continued at all events. Unless the hills are put in by reduced contours and systematic hachures from which the relative levels can be pretty accurately determined, it will be of very little *positive* use save for general topographical indications.

The idea that engineers are enabled by means of the inch Ordnance Survey to lay down a line of railway between places 100 to 200 miles distant, and to see at a glance the course it ought to take, is to me incomprehensible and inconsistent with any experience I have on the subject. A map on half or a quarter the scale, shaded from reduced contour lines, would be of much more positive value to the engineer than the inch scale map as it is, supposing the water-courses to be laid down in both with equal exactness. But the 12-inch scale map, with accurate contours, would enable an engineer to do in a few hours in his office what, with the aid of the Ordnance Map as it is, would require many days, with assistants, in the field.

For any of the numerous uses of maps for educational purposes the one-inch map is too large; but the publication of reductions from the 12, or one inch scale maps, to the scales adapted for these purposes, must be left to private enterprise.

8. *On Contouring.*

The system of contouring consists in ascertaining on the ground, and representing on the map, lines connecting a series of points on the same relative level, each connected series of points being at given vertical distances apart, and referred to the same datum plane,—the mean level of the ocean, for instance.

These lines of level points necessarily *close*, or form a polygonal contour of the ground at different elevations above the mean level of the ocean, and therefore *accurately represent the relative levels of the country surveyed*.

This system of delineating hypsometrical information was first practised in 1782 by Monsieur Dupin-Triel, and applied by him to a map of France. It is considered by scientific geographers the most important step in cartographical delineation made in modern times, has been adopted to a greater or less extent for the maps of all European nations which have made national surveys, except Great Britain, and now rival claims are set up by France and Denmark for the honour of the invention.

Contour lines are for the delineation of the geographical features of a country what the points obtained by the sculptor's compass are to the sculptor. By means of these lines or points mechanically obtained, any one skilled merely in handling the graver or the chisel can re-produce in marble the impress of genius on the clay model, or on paper that of nature on the face of a country. Without these mechanical aids, no skill can accomplish either the *accurate* delineation of a hill, or the *true copy* of a piece of sculpture.

To represent the physical features of a country on a map prepared for economical purposes by means of artistic sketches, appears to me as impracticable a

proceeding as it would be for an architect to give a sketch by a Prout or a Goodall to the artificers who were to carry out the construction of his design, for their guidance.

Replies to the
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scales.

The analogy of the portrait painter who, it is truly said, could not produce a *characteristic* drawing of a person whom he had never seen, by means of mathematical contours, fails, because *personal characteristics* are those of life animated by an immortal soul. The map-drawer has merely to re-produce the *characteristics* of the *lifeless forms* of hills and mountains—graphic representations of the rate at which the hills and mountains rise from the levels of the plains. An acquaintance with the geological structure and architecture of rocks, would, I believe, enable a draughtsman to give more reality to the effect of a hill drawing made on contour lines, than the highest art could produce without contours, and without reference to the *geological structure*.

That contours are sufficient to represent truly the forms of raised surfaces, is proved by the mechanical engravings of bas-reliefs by a *contouring machine*, acknowledged to be the most perfect lineal representations of such subjects or by the mechanical reduction of pieces of sculpture by the machines of Cheverton and Colas, to which we are indebted for the perfect reductions we now possess of the Apollo Belvidere, the Venus of Milos, the Theseus, and other great works of antiquity, and which are the work of machines strictly analogous in their operation to the system of contouring.

It is surely a practical objection to the system of mapping the physical features of a country by means of hill sketches, *that to give those hill sketches value they must be the work of very accomplished artists, or at all events of men with perceptions particularly educated for the work.*

That hill sketching, in the hands of artists however skilled or familiar with the apparently endless variety of forms of hills, cannot do more than give the likeness of the hills—a characteristic drawing, without any *positive* or numerical information—will not, I suppose, be contradicted. Now, opinions are agreed that a map should *indicate the relative levels of the country surveyed, either by numbers or by shading.*

Contour lines, as they infinitely multiply the “numbers” at a small additional expense beyond that of giving numbers, I shall assume ought to be substituted for these numbers, if they are to be used *with*, or instead of, shading.

The question, therefore, is between contour lines and shading by means of skilfully-executed hill sketches. Now I think that the question thus stated is as between substituting *positive* information for *general indications* often very vague.

If the latter be the question, there is no discussion of it necessary. It rests a matter of opinion whether the positive information given by contours is worth the expense of obtaining it! My opinion is that contouring a map will not pay, in the sense that a proportionately greater number of maps will be sold at higher prices in consequence of the contouring being done; but the scientific and practical value of the map will be thereby so enormously enhanced, that it would be most unworthy of the wealthiest nation in the world to omit the opportunity of advancing the science and art of map-making, the example having been set by such states as Saxony, Bavaria, Baden, Wurtemberg, Switzerland, &c.

But I believe that I can satisfactorily prove that if the two districts of Cambridge, Rutland, and Lincoln shires, and Brecon, Monmouth, and Glamorgan shires, had been contoured when the surveys were made, *and the use made of the contours to which they are applicable*, the saving of fruitlessly expended capital on drainage and mining operations that would have resulted would have been sufficient to pay for the contouring of Great Britain.

But the question between contouring and hill shading may be put in other points of view, and I shall endeavour to discuss the notions of the relative merits of contouring and hill sketching which have been put forward in the “Correspondence,” &c.

1st. *Contouring without shading.*—Of a map delineated thus it is said, “It cannot possibly convey to the mind as accurate an impression of the *general character* of a country as is supplied by the one-inch Ordnance Map of England.”

If the word “vivid” were substituted for “accurate” in the above assertion, it might be admitted to be true, that until persons who consult maps have the meaning of contours explained to them, the contours would convey no distinct impression to the mind; but, once understood and appreciated, contours can

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only convey an "*accurate*" impression of the orography of a district, whereas the most finished hill sketches can only indicate that the district is hilly or mountainous, and how these hills are grouped; and it is important to observe, that whether the hill sketches have been made by a Dawson, a Carrington, or a mere tyro in the art, the impression of the *general character* of the country conveyed will be the same, whilst the system of contouring substitutes positive information for pictorial effect, and, *once understood*, must convey the same general impression as hill sketches.

That education is a necessary part of the understanding of maps, has been convincingly proved to me by the preference intelligent young people and knowledge-seeking elderly people, each educated by the same unscientific geographical books, give to ordinary maps over the beautifully raised or embossed maps of Bauerkeller, of which I have had some experience.

2d. *Shading without Contouring*.—It has been said that "the Ordnance Map of South Wales is so perfect a delineation of the country that nothing more can be called for." This assertion is afterwards qualified by the witness saying, "If I add to that map of Wales the height of every principal mountain, hill, and valley, then I have everything I can desire for such a country as Scotland."

My experience of the Ordnance Map of South Wales, as an engineer's exploration map, enables me to offer my testimony to its excellence. It is a very good specimen of hill sketching, but it certainly contains no positive orographical information beyond what would have been conveyed to my mind by a *more accurate* and *complete* delineation of the brooks and streams alone. As indicating the general features of the country, it is most valuable, but its practical value is limited to general indications. It contains no positive information as to the relative levels of the country. It is not possible for an engineer, in *any complicated case*, to predict by means of the Ordnance Map, which of four or five lines through the district will be the line of minimum gradient. It is impossible for a geographer to ascertain the mean, or general, or maximum elevation of the country. It is quite impossible for a geologist to tell the relative levels of boundaries and out-crops of formations by means of this map, and the down-throw of a fault has still to be eliminated from mining operations. The relative levels of the country are shown on the map as a *pictorial effect*. In short, hill sketching is only the perfection of the unphilosophical system of the oldest map-makers, who mixed up pictorial and mathematical delineations in their maps. The system of contouring, on the other hand, represents the hypsometry of a country with the same kind of accuracy as we have its plan by the methods of modern geodesy.

The superadding the work of "*hill sketching*" to maps contoured, or on which the relative levels are indicated by numbers, it seems to me would be seldom necessary; for by the system of hachures introduced by General Van Gorkum, and adopted for special topography in Germany and France, a pictorial effect similar to the best engravings of hill sketching is obtained, while *positive information* is always conveyed.

And this leads me to consider the system proposed by Captain Gosset and the officers of the Ordnance Survey; viz.—

3d. *Contouring combined with shading by vertical hachures*.—"Without the slightest doubt, this is the best method of delineating the physical features of the country."

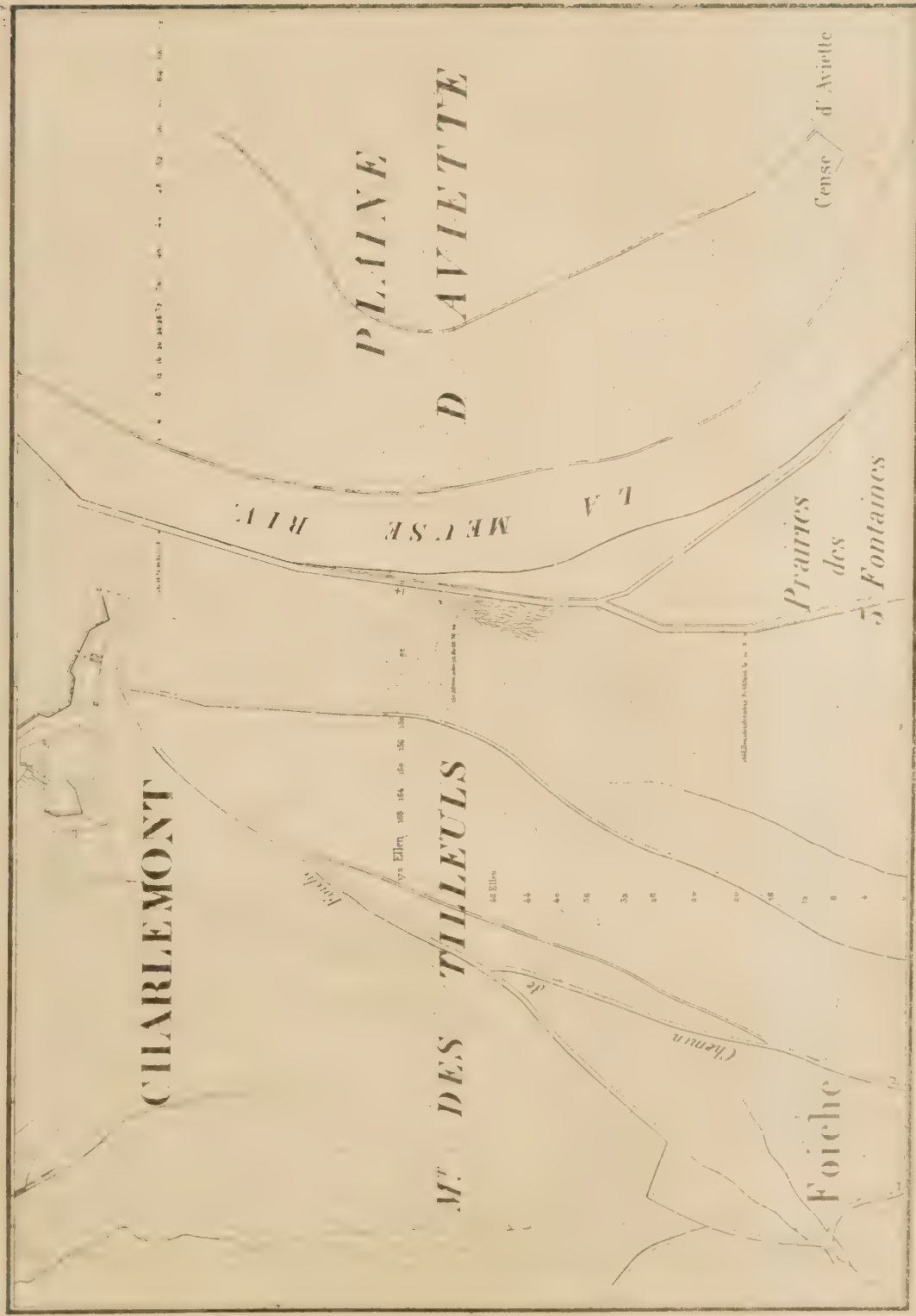
I agree with Captain Yolland and Colonel Hall, that we should have a better one-inch map if it were delineated by the reduced contours, than by any shading from hill sketches.

By introducing the system of shading by a scale of hachures proportioned to the angle of inclination of the surface between the contours, or by interpolating intermediate contours parallel to those laid down on the survey, we should really "have all that could be desired," as will be seen from the enclosed specimens.

The effects, or pictures, would be uniform throughout the map, instead of varying from sheet to sheet as they do; every line on the map would give positive information, and the *pictorial effect* be thus rendered, *mechanically*, all that the most artistic hill sketcher can expect to be rendered by *engravers* not *artists* like himself.

What has been above stated is an attempt briefly to express the opinions formed upon the experience and knowledge acquired during twenty years of a

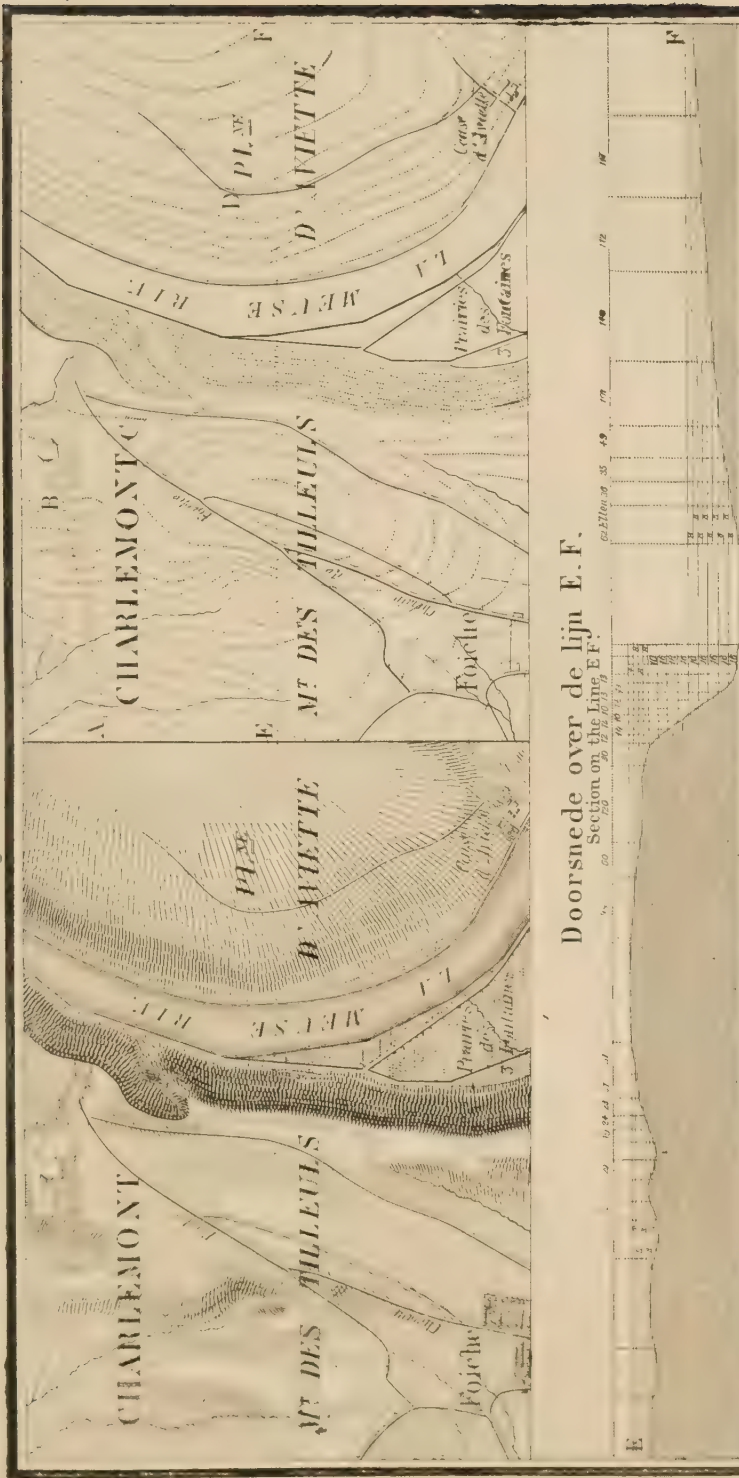
Contour lines on a scale of 1 10,000 vertical equal distance 4 metres-13.12 feet.





Voorbeeld van een Bergachtig terrein op de schaal van 1:20,000.

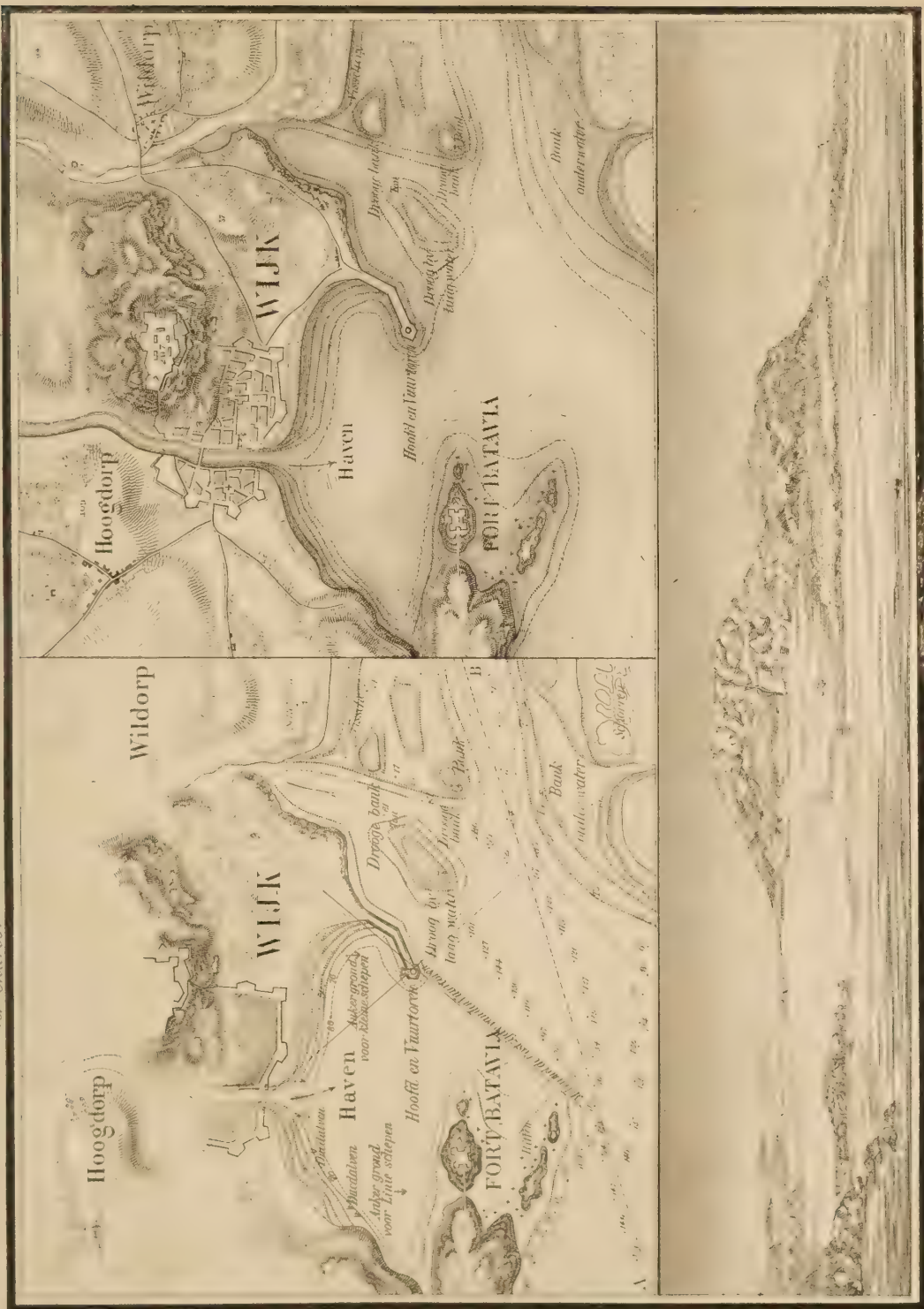
(Hilly ground on the Scale of 1:20,000)



Voorbeeld van Hydrographie op de schaal van 1: 50,000.

voor Zeekaarten. (Hydrographic Plan on the Scale of 1:50,000.) voor Landkaarten.
for Charts. for Maps.

pl. 24.



professional life, in the course of which I have had the advantage of some leisure for meditating on the philosophy of engineering, while engaged in a great variety of engineering practice.

I was prepared to have given the substance of this statement in evidence to the Committee of the Commons which sat in April 1851, but Captain Gosset called upon me after the Committee had determined to close their proceedings. I should have illustrated the statements I have made by the Ordnance Map used in the preliminary search for lines in South Wales, Herefordshire, Worcestershire, Leicestershire, Bedfordshire, &c., and should have corroborated what I said by the following statements of men of unquestionable authority.

“The main use of a map, apart from geographical accuracy, is *distinctness* in the subjects it represents. That we should bring together on the same sheet all matters of geographical moment is inconsistent with the acknowledged principles of mapping. A subdivision of the different subjects-matter—the special representation of each on separate maps—is necessary, if maps are to fulfil their objects.

“By the use of the symbolic hachures on general maps it has been attempted not only to represent the existence of mountain chains and their main directions, but it has been endeavoured to depict their relative height by a scale of shading, so that, generally speaking, the highest hills have the darkest shade.”

The principle is correct in itself, because in hill drawing for topographical objects the proportion of the dark-engraved line to the white field of paper left, is used as an approximate indication of the degrees of inclination of the surface.

“But even for topographical purposes the geometrical basis for the drawing of the relative levels of the surface has been too seldom applied; the determination of the *heights*, and with that, the running of *contour lines of equal elevations*, have been neglected, and *approximate estimates* of the surface inclinations adopted, which, though beautiful as pictures, can make no pretensions to hypsometrical or orographical accuracy.”

“A consequence of this neglect of the determination of levels during topographical surveys is a general over-estimate of the fall of the ground, by which the maps are tinted too deeply, whilst the topographic draughtsmen take peculiar pleasure in representing the smallest deviations from horizontality, and thus fill the map with *hachures*, whereby other topical points of much greater interest are rendered indistinct if not altogether obliterated.”

“If this want of the elements of relief drawing is experienced for topographical plans, how much more must it be the case for general maps in which a whole mountain system, or rather systems of mountains, have to be represented. What scope is given then to the fancy of the hill engraver, who, as experience has proved, is too often turned aside from the naked truth.” “The talent of the draughtsman will not be confined within the limits of geometrical spaces, it overleaps them at the cost of geographical accuracy; the narrower the field so much the better chance for the accuracy of the orographical picture, the greater the field so much the worse.” (See also Captain Yolland’s evidence, a. 1560 and 1562, in the Report of the Committee, 1851.)

“There are maps, produced some twenty years since, upon which the forms of the mountain ranges are drawn with a detail which appears to be all that could be desired, yet we have still to ask in reference to these countries, what is the direction of the mountain chains? what is their relative position? and those who come after us, perhaps a hundred years hence, may still have to ask the same questions without getting a *satisfactory* answer.”

“One of the great disadvantages which the study of geography labours under, especially the general diffusion of accurate geographical knowledge, is, that imagination has taken complete possession of the pens or brushes of our geographical draughtsmen.”

“With reference to the sketching of ground, the method of representing a hilly or mountainous country by lines, approximating to those of equal altitudes, as is shown by Fig. 180, p. 498, will be found very serviceable for geological investigations, especially those where relative altitudes are important, or where the small inclinations of hills can only be measured by the heights they occupy, and at distances too considerable to be ascertained by instruments constructed to measure the dip of rocks (clinometers). The contour lines, or those of equal levels upon some of the Ordnance maps of England and Ireland, and so valuable for many purposes, form an accurate representation of this method.”

Replies to the
Treasury Circular
in favour of other
scales.

H. Berghaus
*Vorbemerkungen
zu Berghaus'
Physalischem
Atlas.*

Sir H. De la Beche.
*The Geological Ob-
server*, 2d edition,
p. 718.

What has been above stated on the subject of contours is, I think, further corroborated by nearly all the *positive evidence* given by Mr. Brunel, Mr. Stephenson, and Mr. Locke, though the tendency of the Parliamentary opinions of these distinguished engineers is evidently *against* the contouring being carried on as begun by the Ordnance in the North of England and in Scotland.

Mr. Brunel says, "The contour lines must be much the most accurate method of delineating a country. The accuracy of hill sketching depends upon the accuracy of the eye of the sketcher, and upon his industry and honesty, whereas the contour lines of course, when taken, afford you the means of shading the map perfectly and accurately."

Mr. Stephenson says, "The contoured maps of Switzerland were of great service in looking over the country; rough sections were made from the contour lines;" and further, "During what is now known by the name of the railway mania, I had rough levels run all over the country at from 5*l.* to 6*l.* per mile."

Mr. Locke says, "Contouring *to be of value* must be a contouring of the whole country."

Mr. Brunel says elsewhere, "*Very early* in railway proceedings the Ordnance map saved the preliminary expenses of searching for the line."

Mr. Stephenson, I think, explains the circumstance when he says, "Because all our great lines of railway are governed by the direction of *the watercourses of the country*;" and further, "the direction of a line of railway through a country depends upon the *position of the population* to be accommodated."

It is evident, therefore, that with these no doubt perfectly correct principles laid down, wherever they would apply, the Ordnance map, being an exceedingly accurate survey and of very convenient size, must have been (and it continues to be) of immense service as an engineers' exploration map. And with reference to these principles Mr. Stephenson very justly concludes, "that there is no possibility of any contour lines leading an engineer to a conclusion *à priori* that a line of railway ought to follow such and such directions."

Mr. Stephenson further says, "It is essential in going through the country to lay out a line of railway, that the engineer should watch every mile he advances, whether he is advancing in the right direction or not. There is not a curve on the London and Birmingham Railway which has not had some good reason for it; but that reason must *have presented itself on the spot*." Therefore, I say, an *accurate survey* is of more importance than any *pictorial representation of physical features* on the map; and perhaps a shading to represent the *relative population* of the country would have been of more immediate service to railway engineers than the hill shading on the map.

Mr. Locke says, "My opinion is, that the interest of the money which it would cost to contour the country would be far more than would enable you to lay out new lines (of railway) for all time to come, and for all purposes for which the surveys and contours are fit."

If this argument were true, it would apply to all investments of capital in works for the diffusion of *aggregate knowledge*. The Encyclopedia Britannica, Metropolitana, or the Penny Cyclopaedia ought never to have been published, because the separate popular treatises they contain could have been supplied at an infinitely less cost than their production in encyclopaediacal form involved.

Perhaps one in ten thousand of those who have bought the Encyclopedia Metropolitana, or who have access to it, have read Airey's Theory of the Tides, or Herschels' Physical Astronomy. Another one in ten thousand reads Coleridge's essay on "Method," or Stoddart's "Universal Grammar," and so on.

If Mr. Locke's argument were true, and we were to proceed thus to take away from the Encyclopedia Metropolitana all that was useless in the railway courses of reading or inquiry, we should reduce it to very diminutive size, and instead of having an enduring monument of the genius and knowledge, and industry and enterprize of the age, we should have an incoherent mass of ephemeral essays, comparable to the thousands of miles of cross sections that must have been accumulated during the railway mania (and before and since), and which are lost to those who paid for them—of no use to themselves or any one else after "*the line*" has been made.

It would be quite out of place here to attempt to treat of the conjectural utility of a good map thoroughly contoured. The attempt would be almost as difficult as to conjecture the utility to the present generation of the publication of the Encyclopedias above named.

As well might we accuse the editors of the Encyclopedias of waste of capital for publishing abstruse metaphysical, physical, and astronomical essays as part of works, the commercial success of which depends *apparently* upon the information they contained immediately useful to the masses of readers, as find fault with the Ordnance Department for spending the public money in contouring the seldom visited, apparently barren mountains of Scotland.

I take my stand upon the opinions of Berghaus, Beaufort, De la Beche, and Brunel, as to the scientific and practical value of contouring; and maintain that on such opinions the question of conjectural utility should be jumped, and the money freely spent on the venture.

Let the 24-inch map be contoured.

Let the 12-inch reduction contain the contours and be used for the hill drawings, with or without the aid of artists to go on the ground, as circumstances may dictate, and let these sketches be engraved on the one-inch map, with the heights deducible from them written in at as many points as possible.

In this way all who desire to see accurate maps, hypsometric as well as geodetic, will be *satisfied*.

From Captain Yolland's evidence I deduce that the producing the map in this way will require no more *time* than producing the ordinary one-inch map, and the comparative expense I consider to be of no moment.

Replies to the
Treasury Circular
in favour of other
scales.

No. 99.

MR. ROBERT DAWSON, late R.M. Surveyor.

RECOMMENDED.

For draft plans of rural districts, as public records	-	-	1 inch to 3 chains.
For plans to be engraved for sale	-	-	Cannot judge.
For draft plans of towns, for records	-	-	Ditto.
For plans of towns to be engraved for sale	-	-	Ditto.

SPECIAL OBSERVATIONS.

The scale for engraved plans of rural districts and of towns, requiring to be adapted to the various wants and occasions for which the plans are required, I should rather recommend some time to be taken on this question, during which access to the original plans may be allowed to the public, and copies, extracts, reductions, &c., given or permitted to be taken, as they are asked for, till it is found what scale is most wanted, as well as what the manner of the engraving shall be, what number of impressions need be provided, and all particulars known, that economy of time, expense, &c., may be insured; but, for myself, I cannot see the necessity in a general national work of having any *engraved* map on a larger scale than that of one inch to one mile.

I have no experience or judgment of the probable requirements for a town plan on a very large scale, but for plans of rural districts, I agree with, I believe, all experienced surveyors, that one inch to three chains is the proper scale for accurate computation of areas from the plots.

No. 100.

MR. RICHARD B. GRANTHAM, C.E., F.G.S.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	120
For plans of towns to be engraved for sale	-	-	60

SPECIAL OBSERVATIONS.

2, Robert Street, Adelphi, August 31, 1853.

I have received the correspondence and memoranda relating to a national survey of the country, and your letter of the 20th instant requesting an opinion as to the scales to which it should be laid down, and I have stated, in the form above, my recommendation; but I beg to make some remarks in support of that

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recommendation, and some suggestions, which I hope may prove useful in carrying out so desirable an object.

I have carefully read and considered the correspondence and memoranda, and by them have been informed of the reason why the results of the survey of Ireland were originally laid down to a scale of six inches to a mile; and I am more confirmed in my opinion that there are no grounds to give a preference to that scale, but strong reasons that a larger one is the best for the plan proposed. That scale may have answered a certain purpose as far as it went; at the same time, Mr. Griffiths admits that the quantities of small parcels could not be ascertained with sufficient accuracy from those maps. I have had some experience in the use of the Irish maps for railway purposes, and have found, although reliable as to accuracy for the Standing Orders of Parliament, it was difficult to insert reference numbers in the fields, and the miles and furlongs figures along the line, owing to the smallness of the scale; and certain descriptions of property must be drawn to a scale of not less than 400 feet to an inch, which cannot be done by the six-inch scale, but must be enlarged; but the 12-inch will come within that size.

I have had personal experience also in surveying in rural districts, both for tithe maps and inclosure maps, and can confidently state that the six-inch scale would not be applicable or even practicable, particularly for the inclosure maps, where the quantities of the parcels of lands to be dealt with require to be most accurate, and the new allotments are to be computed and drawn upon the plan equally as accurate.

The following lineal and superficial measurements show the large differences in the latter, compared with the increasing ratio of the former:—

640'00	acres	to the square inch,	at the scale of 1 inch to a mile.		
17'77	do.	do.	do.	6	do.
4'44	do.	do.	do.	12	do.
3'66	do.	do.	do.	13 $\frac{1}{3}$	do.
1'60	do.	do.	do.	20	do.

which exemplify the advantage of even a slight increase in the lineal scale.

If it should be required to make longitudinal sections having the same horizontal scales as the plans, if they are plotted to the six-inch scale the vertical must be a very high rate of division per inch for feet, to prevent extreme distortion of the surface of the ground, and then it is difficult to read off such minute scales. Whereas with a larger longitudinal scale, a larger vertical can be used, and such as can be more easily measured and reckoned.

The following lists show what are the public and private purposes to which a national survey will, in a great degree, subserve:—

<i>Public.</i>	<i>Private.</i>
1. Tithe commutation.	1. Registration of titles.
2. Parochial assessment.	2. Assurances of land.
3. Inclosure of lands.	3. Sale and transfer of land.
4. Sanitary.	4. Management of estates.
5. Ecclesiastical.	5. Railway and other works.
6. Charity commission.	6. Mineral.
7. Geodesic and purely scientific.	7. Disputed rights and boundaries.
8. Geology.	Public and private drainage.
9. Military.	
10. Naval (coast, harbours, &c.).	
11. Poor Law arrangements.	
12. Police regulations.	
13. Future agricultural and statistical returns.	
14. Generally for public purposes.	

The public requirements for such a survey, so far outnumbering the probable amount of instances in which the private purposes will be applicable, shows clearly which ought to command the greatest attention towards determining the scales and other peculiarities of the maps, so as to justify the increased outlay upon them; at the same time, for each of the above cases of private purposes, a larger scale than six inches is indispensable.

I have also had personal experience in surveying towns, but the case which more particularly drew my attention to the scale to which the results ought to be laid down, was a survey for the Charity Commissioners of part of Chatham and Rochester, where the property is most confined, irregular, and divided into small and large lots under lease, and some of it very much delapidated.

Replies to the
Treasury Circular
in favour of other
scales.

The areas of the leaseholds were computed in square yards, and great accuracy was required. That survey was plotted to a scale of 33 feet to an inch, or 160 inches to a mile, or 13 feet 4 inches; and it showed the drains and privies, which were there clustered together in four or six or eight under one roof, in a manner I had not before met with; but for more general purposes, I consider 33 feet to an inch too large, and 44 feet better.

I would recommend that the cultivated, inhabited, and mineral parts of Scotland only should be laid down and engraved upon the 12-inch scale for the present; but I think it will be worth while to survey the barren parts, and lay them down upon the Record Map, as hereafter they may be more easily and less expensively reduced, and engraved as they become occupied.

I am strongly of opinion that all the enlarged maps should have contour lines, although I agree with Mr. Brunel that they cannot define in their courses the height of every single feature accurately. Still they do serve a most useful and important purpose, and should only be taken as giving a general character of the elevations and depressions of the country. The one-inch maps should have hill-shading, and not contour lines, as they must lead to endless confusion on so small a scale.

My recommendations are therefore based upon the foregoing results of my own experience and consideration which I have given to this subject, not only at the present time, but on previous occasions. And I believe it will be found that the more the industrial resources of the country are developed, and the necessity for greater accuracy and distinctness in the features of the country, the more we shall appreciate these plans of the national survey, if drawn upon the scales above proposed.

It appears to be difficult to arrive at any very distinct estimate of the cost of a national survey, and it will, no doubt, amount to a very large sum, but I am confident that the more generally applicable and useful to all classes that you can make the survey, the greater will be the demand for it, and in a ratio greater than the increased expense due to the larger scales; and on this point, I am sure, it will be found that the objects of private individuals will be so much served by the larger scales as to promote a very large sale. Therefore, upon these grounds, I would further recommend that attention should be especially directed to make the maps as useful for those purposes as for the more general or public ones.

As a national survey ought to be so completely above all question as to accuracy in delineation and faithful in detail, I would respectfully suggest that these maps should be made, if possible, evidence in courts of law, in arbitrations, and before parliamentary committees, being attested by a stamp or signature, and having the date of the time that the survey was made. I have frequently experienced the difficulty of producing the present six-inch maps, owing to a doubt whether they would be received as evidence; and if they were so, it would be highly valuable to all classes, and would often detect fraud and imposition in cases where none of the parties were professionally acquainted with the subject.

Questions have often arisen upon the accuracy of printed maps, owing to the expansion or contraction of the paper, and after much evidence upon the subject, I know of no means by which it can be obviated; but if the original reduction of the 12-inch plans were deposited together with the original 24-inch plans, reference could easily be made to them.

I venture to remark that there appears to be an opportunity, and I think that it would be practicable, of having a decimal acreage, which might be brought into operation co-incidental with the decimal coinage; for, at present, nothing can be more inconsistent than the sub-denominations of an acre. What are roods and perches to us now? The computation into money value is most perplexing. What can be worse than 2*l.* 1*s.* 17*d.* at 22*s.* 6*d.* per acre? Whereas, 2.35 acres at 22*s.* 6*d.* is simple enough.

Replies to the
Treasury Circular
in favour of other
scales.

We have one ingredient towards it in the chain-measure, which represents 100 parts or links, and 10,000 make an acre or 10 square chains. The French denominations are—centiare 1, are 100, decare 1,000, hectare 10,000.

I should hope that from the means of drawing, engraving, printing, and other requisites for such a work which we possess, that a most perfect map, both in accuracy of delineation and artistic effect, will be produced.

No. 101.

COLONEL STOPFORD BLAIR.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	24
For plans to be engraved for sale - - -	6
For draft plans of towns for record - - -	120
For plans of towns to be engraved for sale - - -	60

SPECIAL OBSERVATIONS.

Penninghame, August 31, 1853.

The above, under the impression that the promised reduced scale of one inch to the mile (for general purposes) will be carried out.

No. 102.

MR. HENRY McLAUCHLAN.

RECOMMENDED.

	Inches to a mile.
For draft plans of rural districts, as public records - - -	24
For plans to be engraved for sale - - -	12
For draft plans of towns for record - - -	120
For plans of towns to be engraved for sale - - -	60

SPECIAL OBSERVATIONS.

Haydon Bridge, Gateshead, September 5, 1853.

Under this head I most respectfully wish to state, that the opinion of the scales above given is because, if it be necessary to make the map on so large a scale as six inches to a mile, it were better to incur the additional expense, and make it larger and more generally useful.

With regard to the question of drawing the hills for the one-inch scale map from reduced contours, without visiting the ground, I beg to say I do not consider it possible to do it properly. In explanation, I may observe that I am now engaged on a survey and map of the Roman wall between Newcastle and Carlisle.

The wall runs about west, and is traversed, about the middle of its course, by an elevated edge of the northern coal-field, composed of a bed of basalt, highly inclined, and both overlaid and underlaid by alternating beds of limestone and sandstone, with beds of shale containing both iron and coal. These strata are divided into masses by transverse faults, through which the streams find a passage southward to the Tyne.

The breadth of district may be about two miles, and each stratum presents an edge at the outcrop, more or less rounded by denudation, from the precipitous and columnar edge of the basalt to the steep outline of the limestone, the rounded edge of the sandstone, and the flat outcrop of the shale.

Now as there is great undulation longitudinally from the effects of the faults, as well as from denudation, it does not seem practicable that any contours could give the draftsman such an idea of the succession of these strata as to enable him to make a useful map of the physical features for the geologist, the miner, or the agriculturist, without a visit to the ground.

By Mr. Dawson's method of hill sketching and drawing, the strata find their true position on the map, while the drawing has a general expression of the ground, improved by the touch of the artist. These are taught in the first

place from models, and afterwards from practice on the ground. A person may be a good hill sketcher, but an inferior draftsman for the engraver; and General Colby required the latter always to visit the ground, even with the finished sketches in his hand.

Replies to the
Treasury Circular
in favour of other
scales.

In support of this opinion, it may not be improper perhaps to state, that served for many years in the Ordnance corps of draftsmen, and for twenty years on the Ordnance survey, instructed by Mr. Dawson, under General Colby.

No. 103.

MR. JAMES J. BEATTIE.

RECOMMENDED.

	Inches to a mile.	
For draft plans of rural districts, as public records	-	20 or 4 chains per inch.
For plans to be engraved for sale	-	5 or 16 „ „
For draft plans of towns for records	-	105 $\frac{3}{8}$ or 50 feet „
For plans of towns to be engraved for sale	-	52 $\frac{1}{2}$ or 100 „ „

SPECIAL OBSERVATIONS.

Aberdeen, September 3, 1853.

I received your letter of the 20th ultimo, and the accompanying papers regarding the Ordnance map.

I have used for many years the scale of four chains to an inch, or 20 inches to the mile, in laying down surveys of rural properties, and have found it the most useful and convenient, as it admits of calculations of extent from the paper with greater accuracy than any lesser scale, and at the same time is sufficiently large to permit small objects to be plotted correctly.

If a map is to be made for sale betwixt the one-inch map and any large scale, like 20 inches, then I would prefer five inches to the mile, or 16 chains to an inch. This size would be large enough to show the details of a country, and not too large for being shaded. I consider that an unshaded plan for sale would be a most imperfect thing; indeed, no plan is sufficiently intelligible if not shaded, whatever the size may be, and the larger the size the less so.

If copies are made from recorded plans without shading, for the use of proprietors, they could be shaded afterwards.

In the preparation of national plans it would be desirable if the measure used were applicable to decimal parts. Feet and inches do not permit this.

We have arrived at decimal coinage, and most probably, at no distant period, we shall have decimals applied to all measures.

No. 104.

J. ROBISON WRIGHT, C.E.

RECOMMENDED.

	Inches to a mile.	
For draft plans of rural districts, as public records	-	24
For plans to be engraved for sale	-	12
For draft plans of towns for record	-	120
For plans of towns to be engraved for sale	-	60

SPECIAL OBSERVATIONS.

Manchester, September 9, 1853.

The measurements being accurately made on the ground, the cost of laying them down on paper, to a greater or smaller scale, is not materially increased within the limits in question.

The six-inch scale is now found to be too small for many important public purposes. If it is to be enlarged at all, it would be perhaps best at once to adopt such a scale as would prove to be of the most permanent utility for all national and scientific purposes, and those objects would be secured by the above-named scales.

Replies to the
Treasury Circular
in favour of other
scales.

It may, however, be worthy of consideration, when the details of the plan come to be settled, whether it might not be even still better to adopt the usual scale of three chains to an inch, since the objections that it offers an unequal number of inches to a mile (viz. $26\frac{2}{3}$) is not very serious; for while in a mere general map it is quite natural to refer the scale to the mile, in detail surveys it is the invariable practice to refer to the number of statute chains to the inch.

I now come to the question of contouring the hills: this is a system which involves great expense, while it is but of comparatively small public utility; it affords but a poor approximation towards the effective representation of the physical features of the country; it is not generally desired either by the civil engineers or geologists; and by many persons who use the map, it is really regarded as confusing the outlines. In proportion, too, as any district becomes mountainous (and therefore less cultivated) this system becomes more costly; or, in other words, the minimum of utility is attended with the maximum of cost. The estimate for contouring the whole of Scotland is 120,000*l.* or 4*l.* per square mile.

Having had many years experience in hill drawing on the Ordnance Survey, after being duly trained under Mr. Dawson, I may be allowed to express the opinion, that a better system may be obtained at a greatly reduced expenditure, and one also that would be more appreciated both by professional persons and by the public.

I refer to the system of hill drawing, comprising a scientific and artistic delineation of the features of the ground, as practised by Mr. Dawson in Wales, and so strongly commended by Lord Monteaule, Sir Roderick Murchison, and others; and this system would not only be more useful to engineers and geologists, but it would indicate the natural features of the country much more clearly to all who have occasion to refer to the map.

With regard to cost, I have conferred with competently trained officers, who for several years discharged this duty, and they entirely confirm my own opinion, that an accurate drawing of the ground, ready for engraving, could be prepared at a cost of 10*s.* or 12*s.* per square mile; or, including superintendence, travelling, and other contingencies, that the entire cost would not, under proper management, exceed 1*l.* per square mile.

This being only one fourth of the cost of contouring, a saving on Scotland alone would be effected of 90,000*l.*

No. 105.

MR. J. H. WILLIAMS.

SIR, London, 12, Waterloo Place, September 9, 1853.

IN compliance with the request contained in your letter of the 25th of August, I beg leave to state that the following are the scales which I would venture to recommend for a national survey, to be carried on at the public expense, viz.:—

	Inches to a mile.
For draft plans of rural districts, as public records	24
For plans to be engraved for sale	12
For draft plans of towns for record	120
For plans of towns to be engraved for sale	60

Assuming that the Ordnance survey will be published on a scale of one inch to a mile, a map which I consider indispensable for general reference, I beg leave to add such observations as have occurred to me after reading the papers which you have done me the honour to submit for my perusal.

The evidence of practical witnesses establishes beyond the possibility of doubt that, for estate maps and for public works of all descriptions, the scale of six inches to a mile is all but useless; and, after many years' experience in England and Ireland, I have no hesitation in stating my decided opinion, that if the survey were to be limited to a scale not greater than that of six inches to a mile, it would be much better to omit the six-inch maps altogether, and to confine the survey to the one-inch scale, thus saving to the country the very large expenditure, which I think the Government would be scarcely warranted in incurring to produce a result falling so far short of the requirements of the

public in reference to a really national survey. So important and so great a work should, I think, either be carried out effectually by the Government or not at all.

Replies to the
Treasury Circular
in favour of other
scales.

The scale of six inches to a mile being admitted to be insufficient, the question arises why the scale of 24 inches to a mile is so generally and so strongly recommended. The reason I believe to be simply that a scale, practically equal to it, has been for years universally adopted by surveyors and engineers as the minimum scale with which it is possible to represent on a map all the requirements of a cadastre or territorial survey (for rural districts).

I recommend the maps of rural districts to be engraved and published on the smaller scale of 12 inches to the mile, because a scale practically equivalent to it has also been in general use for years for copies of parish or estate maps, being more portable and convenient for reference than the larger original map, while it possesses the inestimable superiority over the six-inch scale of being large enough to contain the reference numbers and other minute detail, without which a terrier map, however accurate, however well engraved and otherwise "handsomely got up," seems to me absolutely useless.

If these considerations have any weight in reference to the present requirements of a national survey, how much greater should be their influence on the decision of a Government legislating not only for the present but for future generations, whose want of an accurate cadastral survey will be much greater in proportion as the population increases, and as commerce becomes more and more developed from the now inevitable absence of all artificial restrictions upon industry. Moreover, with the rapidly growing intelligence of the people there will arise a demand for perfect equity in taxation and finance, an object that I believe to be unattainable without an accurate survey on a very large, that is to say, a sufficient scale.

With reference to the general map on the one-inch scale, I think it would be but an imperfect, not to say nearly useless, document, without the hill-drawing or representation of the undulations of the surface. I think a simple inspection of two maps, one showing a district truly and at the same time artistically represented by hill-drawing, the other by a purely mechanical system of contours, will suffice to establish at a glance the incontestable superiority of the former method, even if we leave out of view the very important consideration, that the cost of the hill-drawing (including accurate sketching on the ground by artists specially educated for the purpose) and engraving, would not probably be more than about one fourth the cost of the measurement contours, the latter requiring, moreover, a much greater length of time to complete it, not the least important item in connexion with an estimate for a great and urgent national work.

No. 106.

MR. W. RANGER, C.E.

RECOMMENDED.

		Inches to a mile.
For draft plans of rural districts, as public records	-	12
For plans to be engraved for sale	- - -	6
For draft plans of towns for record	- - -	120
For plans of towns to be engraved for sale	-	24

SPECIAL OBSERVATIONS.

2A, Pall Mall, September 10, 1853.

In the course of my practice in projecting works for parliamentary purposes, I have found the contoured plans on a scale six inches to the mile extremely useful, and they have saved the expense of making a new survey.

For the purposes of town drainage, I have tried the plans on a scale of five feet, which I have found is too small for the purpose.

No. 107.

MR. W. MURTON, LAND AGENT.

RECOMMENDED.

			Inches to a mile.
For draft plans of rural districts, as public records	-	-	24
For plans to be engraved for sale	-	-	12
For draft plans of towns for record	-	-	-
For plans of towns to be engraved for sale	-	-	-

SPECIAL OBSERVATIONS.

Tunstall, Kent, Sept. 13, 1853.

I think the above scales much preferable to any less scales—the principal, if not the only, reason which is advanced in favour of the six-inch scale appears to be the saving of expense and of bulk—the former may be an objection, but the latter to me is not one—though whether one or both are objections, I can imagine them compensated for by the advantages of the greater size; and, as regards a sale of the engraved plans, by a more ready sale that will be effected.

My reasons for the larger scales as above recommended are not only the greater advantages they would afford for private purposes in the management of estates, but with reference to general matters under the Exchange Acts, Inclosure Acts, Tithe Acts, Drainage Acts, &c., and any future Acts such as for the Registration of Titles and Transfer of Lands, maps on a large scale would be essential, and any as small as a six-inch scale inadequate.

I should perhaps hardly have considered a 12-inch scale for the engraved maps large enough for all purposes, but I am satisfied as to this if the working plans on double the scale are kept as seems proposed for reference, or to be engraved or copied, either on that or a still larger scale, if necessary, for particular purposes, or for recording on them transfers of property, &c. under any future Acts, &c.

I have confined my recommendation to rural districts, as my practical knowledge of town property is not extensive enough for me to give an opinion.

No. 108.

MESSRS. FOX, HENDERSON, AND Co.

RECOMMENDED.

For the draft plans of rural districts to be preserved as public records	-	-	-	-	-	} 3 chains to an inch.
For the plans to be engraved for sale	-	-	-	6	do.	
For the draft plans of towns for record	-	-	-	20	feet to a mile.	
For the plans of towns to be engraved for sale	-	-	-	10	do.	

SPECIAL OBSERVATIONS.

We fully concur in Mr. Vignoles's opinion as set forth in the accompanying "correspondence."

No. 109.

MR. CHARLES OSBORN, LAND AGENT.

RECOMMENDED.

				Inches to a mile.
For the draft plans of rural districts to be preserved as public records	-	-	-	24
For the plans to be engraved for sale	-	-	-	12
For the draft plans of towns for record	-	-	-	120
For the plans of towns to be engraved for sale	-	-	-	60

Fareham, September 21, 1853.

I CONSIDER a national map should be made of the size I have recommended, for the following reasons:—

First, That in rural districts small pieces of land and buildings cannot be accurately laid down or scaled on smaller maps. In town districts land is divided into smaller pieces, and it is required for sanitary purposes. In many situations land is of great value, and is frequently subdivided into smaller plots, and small plots of different tenure are thrown into large fields and relaid out for buildings, the exact boundary cannot be defined, and an expensive lawsuit

arises out of a dispute of a few feet of land, which might be accurately defined from a map of this scale.

Second, That it might be used for the registration of titles, and the transfer of property. That I believe such an Act will be passed; and if property can be transferred with similar ease to that of railway shares, it will greatly enhance the saleable value of land and buildings.

Third, That it may be used for laying down lines of railway, the inclosure of commons, draining, and the subdivision of parishes, and for many other purposes.

Replies to the
Treasury Circular
in favour of other
scales.

No. 110.

VISCOUNT DALRYMPLE, M.P.

RECOMMENDED.

	Inches to a mile.
For the draft plans of rural districts to be preserved as public records	20
For the plans to be engraved for sale - - -	12
For the draft plans of towns for record - - -	60
For the plans of towns to be engraved for sale - -	

SPECIAL OBSERVATIONS.

The general survey should be engraved for sale 12 inches to the mile.

No. 111.

COMMISSIONERS OF SUPPLY, &c., COUNTY OF FORFAR.

To the Right Honourable the Lords Commissioners of Her Majesty's Treasury.

The Memorial and Representation of the Freeholders, Commissioners of Supply, Justices of the Peace, and Landowners of the county of Forfar, in general meeting assembled,

Sheweth—

That your memorialists have had this day under their consideration a communication from your Lordships' secretary, on the subject of the Ordnance survey for Scotland.

That your memorialists are unanimously of opinion that the survey of cultivated rural districts in Scotland, to be preserved for national purposes, should be made on as large a scale as, according to the opinion of practical men, will render it available and useful for plans of estates, railways, canals, &c.

That in the opinion of the memorialists the six-inch scale is quite insufficient for this purpose.

That an engraved map for publication should be on the reduced scale of one inch to a mile; and also that a map of six inches to the mile should be published for the more populous and cultivated districts.

That the survey of Scotland should be expedited; and that the sum or fifty thousand pounds or such other larger sum as the legislature shall deem proper annually, be voted as an additional allowance for this purpose; and that the staff of surveyors be enlarged.

That the survey of the county of Forfar be proceeded with immediately after the completion of the survey of Perthshire.

May it therefore please your Lordships to cause the Ordnance survey of Scotland to proceed upon the scale above mentioned; that an engraved plan be published on the reduced scale of one inch to the mile; and that a map of six inches to the mile be published for the more populous and cultivated districts; that an additional allowance of fifty thousand pounds be annually granted to forward the survey; that a larger staff of surveyors be appointed for this purpose; and that the survey of the county of Forfar be proceeded with immediately after the completion of the survey of Perthshire.

Signed in name and on behalf of the memorialists in general meeting assembled within the County Hall, Forfar, this 30th day of April 1853.

JOHN OGILVY Bart., Chairman.

No. 112.

MR. G. W. CARRINGTON.

RECOMMENDED.

	Inches to a mile.
For the draft plans of rural districts to be preserved as public records	24
For the plans to be engraved for sale	12
For the draft plans of towns for record	96
For the plans of towns to be engraved for sale	48

SPECIAL OBSERVATIONS.

For the draft plans of rural districts to be preserved as public records I would recommend a scale of 24 inches to a mile, and because the reduction to one-half can be more easily and more accurately made than by reducing to any other scale, I should say that 12 inches to a mile would be the best scale for the plans to be engraved for sale, as this scale would answer all purposes for laying out most kind of works in a general way in the rural districts, and if a plan on a larger scale should be required for any special purpose, recourse could then be had to the original draft plan, which is preserved as a public record.

The six-inch map is not sufficiently large for most purposes in setting out any work where details are to be shown. If a six-inch map were supplied it would not do away with the necessity for making another survey, which would be required on a larger scale, for the working plans. It is next to impossible to enlarge the six-inch map even to twice the scale (which is the most simple) without liability to great error.

I firmly believe that the expense of surveying for a map on a scale of 24-inches to a mile would not be greater than the expense incurred in making a survey for a map on a scale of *six inches* to a mile; moreover, plotting work from the field book to a scale of six inches to a mile would occupy nearly as much time as plotting to a scale of 24 inches to a mile, and the detail of the survey, which must be made for the six-inch scale would be equally as tedious and expensive as that which would have to be made for the 24-inch; for should there be any portion of the detail rejected in consequence of the six-inch scale being too small, so as to admit of its being properly shown, it would be at the time of plotting the work, and *not when the field work* is in progress.

The principal increase of expense would be in the paper, and the increased expense of engraving the map on the 12-inch scale would be, the paper, copper plates, and printing.

For the draft plans of towns for record I have said 96 inches to a mile, and for the plans of towns to be engraved for sale, 48 inches to a mile, which I think would be a scale large enough, excepting for some very special purpose; and these scales being a multiple of the other scales, the reduction from one to the other could be more readily and more accurately executed, and the plotting of the towns on either of these scales would save the expense of plotting on the smaller scales, as they could be easily reduced and adjusted with the nicest accuracy.

The different scales might be called No. 1, No. 2, No. 3, No. 4.

No. 1	-	96-inches to a mile	=	55 feet to one inch.
2	-	48 ditto	=	110 ditto.
3	-	24 ditto	=	220 ditto.
4	-	12 ditto	=	440 ditto.

No. 113.

MR. J. D. NICOL.

RECOMMENDED.

	Inches to a mile.
For the draft plans of rural districts to be preserved as public records	24
For the plans to be engraved for sale	6
For the draft plans of towns for record	-
For the plans of towns to be engraved for sale	-

24 inches for the cultivated districts of Scotland, and for the uncultivated such scale to be left *to the judgment* of the Ordnance officers, and that the same should be reduced and engraved for publication at six inches to the mile.

Replies to the Treasury Circular in favour of other scales.

SPECIAL OBSERVATIONS.

I am induced to offer the above recommendation from a conviction that, as a national work, likely to combine so many ulterior objects, it should be undertaken on a scale by which such are likely to be attained, and that no money could be more judiciously expended than in a national survey on a scale which could not fail to be of great practical benefit to all classes of the community.

No. 114.

MR. W. E. GAINE.

RECOMMENDED.

	Inches to a mile.
For the draft plans of rural districts to be preserved as public records	24
For the plans to be engraved for sale	12
For the draft plans of towns for record	120
For the plans of towns to be engraved for sale	120

SPECIAL OBSERVATIONS.

4, Harewood Street, Harewood Square, Oct. 12, 1853.

I HAD not the honour of receiving your letter and enclosure of "correspondence," bearing date the 25th August, on the scales recommended for the construction and publication of the Ordnance maps, till recently on my return to town; and since then I have given my earliest and best attention to the subject.

Assuming that the Government propose carrying out a higher class of surveys, more suited to local interests, and available and efficient for future public contingencies, in reference to property, I would observe, that the test of the value of any particular scale is, the uses to which it can be applied and which it is competent to fulfil; and in this view of the case I think it will be found that the 6-inch scale, though applicable for what was required of it in Ireland, is not fitted to the present condition and future wants of England or Scotland.

It is too small as an estate plan; and for all fiscal purposes, poor's rates, tithe commutations, local assessments, disputed rights, and boundaries of property, for working mineral surveys, for general registration of property, and for nearly all agricultural and statistical objects, such a plan is inappropriate; you can make no calculations on it for content; there is no space for reference numbers; and in many cases the minute divisions of property, which are absolutely necessary for these fiscal arrangements, cannot be shown.

On the other hand, for everything that a general map of a country should subserve, the 6-inch scale will be found as much too large, as previously it was too small.

Put the sheets together to see it as a whole, and the eye cannot embrace the space; there is no relief to guide it; no impression is conveyed to the mind of the aspect, form, and physical character of what is viewed; mountains and streams must be searched for, instead of being seen at a glance; a knowledge of what is desired must be obtained by laborious investigation, instead of almost intuitive perception; the work manifests itself as a plan, and not as a map, and is unsuited for primary geological and military uses, preliminary engineering, and those many other purposes for which a map of a country is so desirable. In fact, it is impossible to combine the design of a map of a country, and a plan together; the general physical aspect and character, with the minute detail and subdivisions of property.

Replies to the
Treasury Circular
in favour of other
scales.

In reference to town surveys, when it was recommended by the Health of Towns Commission to have those localities planned on a large scale for sanitary purposes, judging from what had been done by the Ordnance in Ireland and Lancashire, five feet to the mile was considered an ample scale; and on this supposition the block plan of London was subsequently laid down.

But in practice, when it became necessary to work out the detail, that scale was found to be too small for the purpose, and too large for general reference, obliging a smaller plan of twelve inches to the mile to be executed, and the five-foot work to be plotted (where required) to the scale of ten feet to the mile.

Other towns, though possessing the five feet plans, (as in the case of Liverpool,) had surveys completed on increased scales for the development of their sanitary and public improvements; and I should only be uselessly occupying time in naming the many places that have since had their surveys constructed on a ten feet or larger scale, that of five feet not being sufficient for the clear exhibition of particulars, where it was requisite to take into consideration the drainage, water supply, and gas details.

If then it is desired to have the national surveys efficient for all civil and military purposes, to preserve the originals as records, and to publish on a minor scale, I am of opinion that the scale of 24 inches to the mile, reduced to 12 inches for publication, would be the smallest admissible for the objects to be attained; whilst for city and town surveys I should deem ten feet to the mile the most advantageous both for record and publication, so far at least as places like Edinburgh, Glasgow, Paisley, Newcastle, &c., &c., are concerned. There are so many purposes for which working plans are in such towns daily required, and for which the five-foot scale is too small, that the Government would be conferring only a partial benefit, if it stopped short of the publication on the larger scale. Indeed I should think that the great cities would be glad to bear the extra cost to have the work so done.

Though much has been said and written, and much evidence taken on the Ordnance surveys, more remains unpublished and not generally known; parties have spoken as far as their information went, but their conclusions, based on partial knowledge, have been incorrect. And let me here observe, that in any statements which I may make, I desire to advance what I have to say without giving offence to any one, my object being the truth and to express my convictions so forcibly, that, if correct, they may not fail to make a right impression for want of a full, candid, and free statement. Thus, in the evidence on the Scotch survey, Messrs. Stephenson and Locke have been led away by this cause. Mr. Stephenson, in answer to question (1,897, Ordnance Survey, Scotland, Report,) states, in opposition to the officers of Royal Engineers, "that he could lay his hands on fifty good hill sketchers in a week;" and Mr. Locke, in answer to question (2,005), confirms Mr. Stephenson's assertion, stating the facility with which he had procured a most beautiful drawing of the Delvine Pass by one of his staff in three days, to decide a case then pending before a Committee of the House of Commons. Had the first-named gentleman been conversant with the *modus operandi* of true hill delineation, he would not have made that statement, nor would Mr. Locke have selected the production of one of the most successful of Mr. Dawson's pupils, trained especially by him for that particular service, in confirmation of his statement; for had Great Britain been searched it is questionable if a dozen others competent to the task could have been found, much less to have done it in the time named.

Mr. Locke's explanation affords, therefore, a happy exemplification of the use and value of good hill delineation by a master hand, and is no illustration of the facility of procuring fifty such hill sketchers in a week.

The person who made the drawing was Mr. F. A. Carrington; and no private surveyor that ever I have met with, unless trained by Mr. Dawson or through some one instructed by him, has been at all conversant with hill drawing; there are many of them no doubt cognizant of the principle on which the practice is based, but they know nothing of the practice itself. A copyist from a drawing previously made might be found, but not one competent for the field; and to make the combined finished drawing from the field sketches requires a still higher degree of qualification.

In the evidence, (Ordnance Survey, Scotland, Report,) Quarter Sheet S.W. 91, of the one inch, is put forward as a specimen of the manner in which it is proposed to engrave and publish the rest of England and Scotland, by reducing the contours from the six-inch, and producing an effect of hill shading by vertical hachures at right angles to the contours, and which is held by Captain Yolland (evidence, 1611 and 1612,) to be a better system, superior in accuracy, and equal in execution to a careful hill delineation; and Colonel Hall (evidence, 908,) says, "I think they would have a better map if it were delineated by the reduced contours instead of by hill shading."

Replies to the
Treasury Circular
in favour of other
scales.

Before a decision is come to on this point I would suggest a comparison of Quarter Sheet S.W. 91, on the one-inch, and Sheet 51, of Lancashire, on the six-inch (of part of which it is a reduction).

On the six-inch the instrumental contours are run at 25, 50, and 100 feet severally above the sea, and the interpolated water levels at every 25 feet above the 50 and 100 feet contours; we thus arrive at the fact that there are five horizontal sections through the sheet.

Now the first thing that strikes my attention on comparing the plan and map is the omission of the valley and hill between Brackinscal and Great Singleton Church, the rise from the cross roads to the church in a quarter of a mile being 29 feet, and to Brackinscal 26 feet, the total height at the church 69 feet, and the opposite side of the valley 66 feet.

The whole then of an important feature in a gently undulating country is wanting on the one-inch.

Near Weeton Lane Ends there is a windmill marked 132 feet high, and close to it an interpolated 125 feet contour, making the ground there a distinct feature (a knoll), yet the shading from an adjoining 125 feet contour is carried quite over this higher ground with its separate contour as if it were beneath it and did not exist.

Close to High Comply a trigonometrical station is marked 71.6; the shading to represent the hill, however, is only carried up to the adjoining 50 feet contour, and the summit of the feature is altogether left out; a little more than two thirds is shown and the rest cut off.

So it is with an adjoining hill, marked 87 feet; so also with the ground at Little Marton; so at Blackpool; and the same at High Furlonghouse and Little Carleton. But it is needless to go on multiplying cases; there could hardly be a more signal illustration given of the utter failure of a principle than this quarter sheet exhibits; imperfect and incorrect, it is not a drawing of the ground, it is not the physical aspect of the country; one third of the subject cut off, and the shading irrespective of form, it cannot be compared with a careful hill relief delineation; it is a step, and a very long one, backward in the art of topography; it cannot be too strongly objected to and condemned as an exhibition of the progress of the Ordnance Survey Department at the present day.

In reply to question 1,482 (Survey, Scotland, Report), Captain Yolland says, "I instanced more particularly the hill sketching, which is a very important and costly part of the one-inch map; and I am sure, that although we could get over the mechanical parts, as regards the surveying, and the detail, and the drawing of the plans, which in all cases precede the sketching or the contouring, still we cannot get the people who can do the other, so as to do it in one third the time."

In reference to this I would observe that the hill sketching, per se, is not so costly as represented, and that it was in failing to get over the mechanical part of the work by the means employed that an additional duty was thrown on the hill sketching department; this it was which so unduly raised the cost of the one-inch map; the mistake of employing uneducated and imperfect hands to produce a work requiring judgment and discretion; it was in correcting the errors and omissions of those parties, that the time of the hill sketcher was occupied in order to fit the work for publication, and hence an estimate unduly high (10% per square mile) is now fixed on as requisite for the survey of Scotland on the one-inch scale.

In 1835 General Colby, conceiving that the highly organized machinery he was then successfully employing in Ireland for the six-inch scale, would be attended with benefit and a reduction of cost, if applied in England to the one-

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inch map, detached a party under Lieutenant, now Captain Bailey, R.E. (retired), for that duty, and portions of the counties of Norfolk, Suffolk, and Essex were surveyed by them.

In 1837 they continued the work through parts of Nottinghamshire, Derbyshire, Yorkshire, Lancashire, and Cheshire, comprised in sheets 71, 72, 80, 81, 82, 87, 88, and 90.

This is the district last published on the one-inch scale by the Ordnance, previously to the introduction of the six-inch survey into England; and its aspect and physical character, the mode of execution, and success of the work, are important subjects for consideration in the present discussion.

Between Derby on the south and Leeds on the north, the Trent on the east and the Irish Channel on the west, there is a tract of country, about sixty miles long by ninety wide, through the heart of which, bearing gently from the north-west, is the central ridge of England, 1,500 to 2,000 feet high, with the Lancashire and Yorkshire coal fields cropping out on its northern slopes, and dipping to the south-west and south-east respectively.

The rivers pour their waters directly into the Irish Channel and German Ocean, till the main ridge, culminating in the High Peak of Derby, is thence southwards divided into two, to make way for the upheaved mass of mountain limestone (of which the greater part of that county is composed); the grits being thrown off on either side of it in a continuous range of high barren moors and broken edges, revealing the scenery which most persons are acquainted with at Matlock, Buxton, and Dove Dale.

The next marked feature on the eastern side is the magnesian limestone ridge, lying along the border of the coal strata, 200 feet to 600 feet high, and gradually dying off eastwards, in the soft features of the new red sand, till lost in the valley and flats of the Trent.

This tract, 14 to 16 miles wide, may be truly called an historical one; the battle field for the decision of early domestic feuds.

From the Roman period to the present day the best route northward; its course is dotted with castles and camps; Nottingham on the Trent; Conisboro' and Doncaster on the Don; Pontefract and Castleford on the Aire; Tadcaster on the Wharfe; Aldboro' on the Ouse. It has been the scene of contention at Northallerton, at Tawton Field, and at Doncaster; it witnessed the raising of Charles's standard on Nottingham Castle, and its final fall at Marston Moor.

Now, how has this country been represented? so extensive in scope: so varied and beautiful in character: rugged, broken, and picturesque in the centre; soft and gently undulating on its sides. Put the sheets together: call to mind its true aspect: and then behold its motley representation!

I cannot look at it without a feeling of sorrow and deep regret: seeing what it is, and knowing what it ought to have been.

But how has this happened? Whence so great a failure? Why are not the quarter sheets uniform,—the work brought out as a whole? It was done at one time! By one set of assistants! Under one direction! A favourable conjuncture for uniformity and perfection of result.

I have already mentioned the transfer of assistants imperfectly qualified: the introduction of the division of labour system, as pursued in Ireland.

This system provided that one party should attend to the triangulation in the field; another make the calculations in the office; one set to survey, who could just keep a field book; another protract the lines so measured; another plot the offsets, and make a tracing for the outline sketcher to go on the ground with, to examine, insert omissions, and draw the plan.

Arrived at this stage, the mechanical part was in the first instance considered perfect; until the hill sketchers, in going over the ground to insert the hills, found it very indifferent.

From the want of skill and judgment in those previously employed, there was so much omitted, so much to correct, that it became necessary to throw the final examination on the hill sketchers, and make them responsible for the accuracy of the work.

Is it just, then, that, owing to the previous want of skill in the mechanical department, the hill delineation should be charged as the heaviest item of the expense? The time was not occupied in hill sketching so much as in examining and correcting the imperfect outline.

The two-inch maps completed thus far, were, with the field hill sketches, forwarded to the chief map office, where the outline was reduced and drawn to the one-inch scale for the engravers; and when the engravers had cut the outline in on the copper, a dry proof was taken on good paper for the final hill draftsman to make his relief drawing upon.

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To do this effectively, it must be manifest that the party entrusted with the work should be perfect in his vocation,—should see and be acquainted personally with the character of the country to be represented; as it was his duty to combine the multifarious drawings of many persons, to harmonise individual peculiarities, and produce a perfect whole.

For some part of the work this was attended to; the ground was visited, and a better and more uniform tone resulted. But when, towards the advent of the six-inch survey in England, the one-inch map was deemed of very secondary importance, it was thought to be an unnecessary and useless expense to have the ground visited, the services of the higher and more efficient class of assistants ceased to be appreciated; even the duty of the superior hill draftsman, it was thought, could be performed at a saving of the public money, without visiting the ground, by a person who did not know how to do the work in the field.

In such hands the quarter sheets must, of course, bear the impress of the system,—a copyist of each style; the faults or excellences of the field sketchers are exaggerated and made more striking by the contrast of opposite qualities in each; here, part of a range of hill dark and clear; there, another part muddy and thick; and next to it, something so light as to convey the idea that a great change had taken place in the geological formation and physical aspect of the country; for the engraver, from habit and practice, aims at a fac simile of what is placed before him, and hence an indifferent drawing must be the parent of an equally indifferent plate.

No set of field documents for the one-inch map were ever more carefully got up; sketched by the same persons who prepared the much admired quarter sheets of Wales, under Mr. Dawson; and who, on his retirement, had been transferred to this work; the failure was not in the field, but in the preparation and publication of the work in the office; it suffered from a mistaken economy, and an unfortunate misapprehension of its utility and value.

But what is the remedy? How is Scotland and the rest of England to be done? As regards Scotland, I have already advocated the alteration of the six-inch scale to one of 24 inches to the mile for record, to be reduced to 12 inches to the mile for publication. I would be clearly understood, however, as restricting this large scale solely to the cultivated, important mining, and populous parts of the kingdom; to extend it to the open and wild highland region, would be a waste of money, and useless; for such tracts the two inch, reduced to the one, is sufficient, and to carry out the smaller scale effectively, I beg to offer a few more observations.

In altering the six-inch scale, and confining the larger one, proposed to be substituted in its place, to a certain class of localities, the preparation of a general one-inch map, after the manner of quarter sheet S.W. 91, of Lancashire (already commented on), is no longer practicable.

It will be evident, from what I have previously said, (through the experience gained on the English one-inch survey,) that the system of division of labour, based on the being able to make use of a low-paid, uneducated, and ignorant class of persons, is unsuited for a work of this nature, as it absolutely entails an increased cost, in compelling a resort to the very assistance which it was sought to discontinue.

What remains, then, but to turn to a more efficient method, such as suggested by Colonel Dawson, R.E., in his letter, page 41 of this correspondence, to train a select and intelligent class of persons, to aim at the highest excellence, making the Welsh quarter sheets the starting point,—not the standard of achievement,—to progress from, and improve on them by diligence, energy, and zeal; to place such a staff under experienced officers, zealous and interested in the duty, with an efficient head to direct and control the whole, lest the best efforts in the field should be paralyzed in the office; and a work worthy of Great Britain and the present state of science will be accomplished.

The great defect of the English one-inch map is, want of uniformity in the execution, and the absence of an extensive series of altitudes along the vallies and main and subsidiary ridges of hills. In the earlier published sheets the rude state of the hill delineation is very marked, on comparison with the later

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and more beautiful drawings of parts of Wales, where the first decided step in the correct representation of hill relief is observable.

A just appreciation of its merits has yet to be awakened in the public mind, and great and important objects will be served by the right application of it, when its value shall become generally known.

At present too many persons are satisfied with a rude conventional mark to indicate the position of hills on maps; and, when the altitudes are added it is deemed that nothing more can be required. Others again would have a few contour lines drawn up to a certain altitude, and prefer a map with as little shading as possible, because the shading they have been accustomed to gave no correct expression; it was badly done, and obscured instead of adding to the definition and clearness of the subject.

But, what an amount of invaluable knowledge is given by a correct delineation of ground! every geological group of strata has its own characteristic form; the chalk, the new red sand, the carboniferous, the slates, and primary rocks; each possesses an individuality to be distinguished at sight, when properly drawn; place such a model drawing of a newly discovered country before an accomplished geologist, versed in these forms, and he will at once draw conclusions and direct investigations fraught with important consequences.

It is not only, therefore, as a mere picture that such a map is to be valued, but for the amount of information which, from its accurate and truthful representation it is capable of conveying, if we are in a condition to apply it.

Scant physical data sufficed for Sir R. J. Murchison to predicate the existence of gold in Australia. What might not, then, be expected with perfect documents? Ideas would suggest themselves to our military and civil engineers that would otherwise never occur, and benefits wide as the world would flow from them.

How has our progress hitherto been retarded for want of such maps, and our knowledge of them confined! What a benefit would Canada now receive did she possess one! What delay has occurred at the Isthmus of Panama on this account!

With the government of India looming in the distance, its physical map a first necessity for the quick development of its resources; what is Scotland but a school for wider efforts,—a field to prepare for future exigences? And, if this view is not beyond the scope of the present inquiry, it may perhaps exercise some influence in the organization to be adopted.

No. 115.

MR. LUCIUS HENRY SPOONER.

Munlochy, N.B., 12th October 1853.

I HAVE the honour to acknowledge receipt of your communication of 20th August, and of the correspondence on the above subject which accompanied it. I have carefully perused the latter, and sought the opinion of other persons in this country on the subjects of inquiry. I have likewise endeavoured to ascertain from parties in Ireland how far they have found the survey of that country applicable to their use.

The opinions expressed in the accompanying observations are borne out by the experience of those I have consulted.

I have taken the liberty of suggesting two points for consideration, one of which, viz., that of the public possession and maintenance of local maps in the different districts throughout the country, I would urge as a matter of great utility and importance; as far as I can gather, the maps at present preserved as public documents are not used or referred to in anything like the extent they would be if there were readier access to them, and I conceive the course I have suggested in this respect to be perfectly practicable.

RECOMMENDED.

	Inches to a mile.	Replies to the Treasury Circular in favour of other scales.
For the draft plans of rural districts, to be preserved as public records - - - - -	20	
For the plans to be engraved for sale - - - - -	1	
For the draft plans of towns for record - - - - -	} Have not sufficient experience to offer a recommendation.	
For the plans of towns to be engraved for sale - - - - -		

SPECIAL OBSERVATIONS.

The subjects to which my experience in the use of maps relates, are:—

- The general drainage of land ;
- Reclaiming of wastes ;
- The arrangement of inclosures ;
- And all ordinary agricultural purposes.

For the delineation of the details of these objects maps on a scale of three or four chains to the inch are found quite adequate, whereas maps on a scale of twelve or thirteen chains to the inch would be of no service for such purposes ; a map on the latter dimensions is sufficient to indicate the direction of roads and watercourses, to show general outlines, and the relative position of farms, &c., but when the lines of subdivision, and so forth, are sufficiently distinctly marked to stand the ordinary wear and tear of a map of reference, too much of its actual surface is occupied by the delineation of margins for the accurate insertion of minor lines. From such a map the extent of large blocks of land probably may be ascertained with accuracy ; but, unless its divisions are drawn in lines, which would render it a most undefined skeleton, I cannot conceive the accurate extent of small plots, or the direction of irregular boundaries, being ascertained without having recourse to a fresh survey.

A plan on this scale would be wholly inapplicable to the purposes of the farmer ; it would be of little or no service in reference to reclaiming of wastes, or to drainage (other than large arterial drainage,) especially where two or more properties are mutually concerned in the same undertaking ; I cannot conceive it sufficiently definite for the purposes of registration of land, nor yet for those of minute statistical inquiry ; so also, in that fruitful source of litigation, viz., the boundary line of adjacent estates, so small a scale would afford but meagre evidence, especially in those instances where irregular boundaries separate properties of high acreage value.

On the other hand, a general map on a scale of three chains to the inch, or of four chains to the inch, is fully adequate for all ordinary agricultural and drainage purposes, as I conceive it would also be for the others above-named ; and, equally with the smaller scale, would be subservient to all those for which it is applicable, while, with them, it combines such as the smaller scale can never reach.

The facility it would afford to the sale and transfer of land, apart from all the other considerations, alone presents a strong plea in favour of its adoption.

Of the two principal objections which seem to arise against the adoption of the larger scale, viz., its greater bulk and greater cost, the first appears to be fully met by the contemplated publication of the one-inch to the mile map, which would probably be adequate for most purposes of general reference, and form a sufficient basis for the reduced maps published by the trade for travelling and other geographic uses.

The second objection, viz., its greater cost, is fairly met by the manifest fact of its far more extensive applicability ; but if, notwithstanding this, it were held to be objectionable to put the country to the extra expense for the convenience of those persons who would reap the principal benefit from it, I would respectfully suggest a course by which an object of very general utility could be secured and the extra cost refunded ; this I will endeavour briefly to explain. A map on the large scale alluded to, if rendered easily accessible, would form subject of constant and repeated examination and reference ; numerous copies

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would be taken of plots of land, of farms, of estates, &c., and it would be highly desirable if duplicates of the original plans of any district could be kept within reach of the public in that district, so that all persons could have such access to them as can be obtained to the registers of births, &c. or similar public documents. And I would suggest that such copies, together with reference copies on the smaller scale, should be kept in each county town, accessible to the public at all times. The extra expense incident upon the survey, the cost of furnishing the copies, as well as that of keeping them, and of replacing the maps when required, could be repaid by moderate charges against the persons using or referring to them; or if it were thought that the repayment in this manner would be uncertain in amount or spread over too long a period of time, a rate on the land might be created, which (considering the convenience and saving which would arise by the easy access to such maps to almost every person connected with the land and liable to pay rates,) it is hardly probable would be either felt or objected to.

The extra cost of making a map on the larger scale is estimated in Mr. Vignole's letter of the correspondence, page 44, at 2*d.* per acre, with a certainty of its not exceeding 4*d.* per acre; even at the latter cost, a rate to repay it within two or three years time, divided between landlord and tenant, would form but a very trifling charge against each individual.

For all local purposes a locally kept map would be highly servicable, but in none more so than in the sale and transfer of land, where an easy reference by any party to this acknowledged standard of accurate delineation would frequently do away with many of the difficulties which arise from obsolete terms and incomprehensible or faulty sentences, too often found in old title deeds.

Whilst the larger scale is to be recommended for all the arable districts, and for land which is capable of being made arable, of which latter there exist many extensive tracts throughout Scotland, it manifestly cannot be of the same importance to lay down on a similar scale those parts which are and ever must be uncultivated pastures; for such tracts I am of opinion that the scale of six inches to the mile would be ample.

I venture an observation upon what might be made the line of demarcation between the two scales.

As far as I have been able to observe, the limit of profitable cultivation in Scotland (with the exception of particular localities attached to one line of geological formation) is within 600 feet of the sea level, the ordinary range of cultivation being considerably lower than that point, but many of the river valleys (straths) are capable of profitable cultivation to a greater altitude than the hill sides and slopes; I would therefore suggest that a level above the sea, not exceeding about 600 feet, should be made the margin for the larger scale for all bank and sloping and flat lands, and that it should be continued up the valleys of the principal rivers, so far as the average width of the flat lands of the valleys exceeds or comes up to one mile.

No. 116.

THE GENERAL BOARD OF HEALTH.

Replies to the
Treasury Circular
in favour of other
scales.

Whitehall, October 27, 1853.

IN accordance with the request contained in your letter of the 20th April last, with reference to the scales, which, in the opinion of the General Board of Health, are best adapted to a national survey, I am now directed by the Board to transmit to you, for the information of the Lords Commissioners of Her Majesty's Treasury, the accompanying copy of a report by Mr. Austin, which has been approved, after full consideration by the Board, as embodying a summary of the Board's experience under the Public Health Act.

I have, &c.

C. MACAULAY, Secretary.

REPORT ON SCALES FOR THE NATIONAL SURVEY.

To the General Board of Health.

MY LORD AND GENTLEMEN,

HAVING, in accordance with your instructions, attentively perused the correspondence and memoranda respecting the Ordnance Survey, transmitted from the Lords Commissioners of Her Majesty's Treasury, with the request that your honourable Board would state in an annexed form what scales you would recommend for any national surveys which may henceforward be carried on at the public expense, I beg to submit my opinion that the following should be recommended :

	Inches to a mile.
For the draft plans of rural districts to be preserved as public records	24
For the plans to be engraved for sale, the whole plan	- 1
Ditto, except extensive mountainous unimprovable districts	6
The cultivated, improvable, and populous districts	- 24
For the draft plans of towns for record	- 120
For the plans of towns to be engraved for sale	- 120

In submitting these scales for the consideration and guidance of your honourable Board in replying to Sir Charles Trevelyan's letter, I am the more anxious to avail myself of the opportunity afforded for adding any special observations in support of my opinion, because the experience which has been obtained under the Public Health Act on the question of surveys is of a special kind, and extends beyond the considerations which had before been brought to bear upon the subject.

A better time could not have been adopted for the fullest inquiry.

It must be admitted that the directions under which the Ordnance survey operations are conducted, are not in keeping with the present and growing importance of the subject. Already vast expense has been incurred for multiplied surveys which might have been avoided under other arrangements. Recent experience proves that the Ordnance scales are inadequate to many most important purposes which a national survey should subserve. No possible blame could attach to that service for such insufficiency, for the necessity for larger plans has chiefly arisen subsequently to the adoption of those scales ; but all the arguments used by Colonel Colby in 1840 in favour of the 6 inch scale for England have greater force in 1853 for the *addition* of still larger scales. If these are not adopted now, they must be at some future time when further waste has been incurred. This is now so manifest that I should not have thought it necessary to urge this warning, were it not that this desirable and important change meets with the opposition of the Ordnance survey officers.

Your honourable Board are aware of the extended inquiries and many trials that were made, and the great consideration that was given to the subject before I had the honour of recommending to you the adoption of the 2-feet and 10-feet scales for the purposes of the Public Health Act. These scales were received with considerable difference of opinion ; but when as many considered them too small as too large, I felt satisfied that they were not far wrong. All the subsequent experience of the practical working with the plans drawn to these scales has been most satisfactory, and it is gratifying to find

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them now confirmed by the recommendation of their adoption for the national survey by the highest authority, Lieut.-Colonel Dawson.

Strong objections, however, have been urged by the Ordnance officers against the 10-feet scale from the first. Colonel Hall attempted to show that it was quite unnecessary, by reducing the specimen plan of your Honourable Board to the Ordnance 5-feet scale, and he could not have exhibited a better proof of the *practical* insufficiency of their scale for the purposes of sanitary improvement. Colonel Tucker prepared a specimen plan with an ingenious system of symbols to be used with the 5-feet scale. Captain Yolland proposed a method of references on the plans to the required information, to be kept in books. Captain Gosset has strongly urged that the 10-feet scale increases greatly the expense, and is quite unnecessary.

In opposition to these opinions, I believe that the practical testimony might now be brought of every engineer and surveyor who has been connected with works under the Public Health Act, and has had good experience of the actual use of the 10-feet plans.

At Preston, although the 5-feet Ordnance plans were ready to their hand, the local board have had that scale enlarged to the 10-feet at very considerable expense. In other smaller places the same course has been pursued. At Hull this enlargement is in progress by the Ordnance themselves, at the request of the local board; and in all places where this alteration has been carried out, it may safely be said that the local boards and their officers perceive its great advantage. At Dewsbury, in consequence of some misunderstanding, the attempt has been made to fill in on a copy of the 5-feet Ordnance plan, the additional information required for carrying out the works of sanitary improvement, and although carefully drawn, the plan is so crowded and confused as to render it most inconvenient for its purpose, if not practically useless.

In the face of such testimony and of the decided opinions expressed by the high authorities consulted on this subject, it is to be hoped that the Ordnance survey officers will no longer endeavour to maintain a scale of work which, however well adapted for the various purposes which came under their consideration when it was decided upon, is no longer adequate to the requirements of the time.

Referring to Colonel Colby's report of 1840, the Duke of Wellington stated in his letter, "The perusal of this paper will show how important it is to fix and define exactly, before the survey is commenced, what are the objects on which it is desired to obtain information and to which it is intended to apply the same when obtained."

Those various objects have been well defined in the letters of Colonel Dawson and Mr. Vignoles, and it will not be necessary that I should enumerate them here; but a consideration of these numerous important purposes which a national survey should subserve, leads me to the conviction that *the scales of such survey should be graduated and progressive*. It is not a question of which is the one best scale to adopt. The great objects of a *national* survey are not to be realised by any such narrow consideration. It would be unworthy of the name.

The great advantages of a *general* plan of the whole country to one scale (such as an inch to a mile) is admitted, and needs no further illustration. Over vast districts, mountainous and unimprovable, even the 6-inch, the next scale proposed in progression, would appear to be inconveniently large, and a 3-inch would be preferable; but as we approach the more cultivated areas this scale is clearly sufficient only for a proper delineation of the features. Yet nearer to the centres of population, and the 6-inch in its turn becomes inadequate; the 2-feet scale will then only accommodate the public requirements. For the villages and suburbs of towns the 5-feet would be sufficient. In the towns themselves the 10 feet scale is only adequate to the clear delineation of the features, but as we proceed to the dense spots in the very heart of the largest population, even this scale scarcely suffices for their proper exhibition for practical purposes. These remarks may sound as truisms and may appear unnecessary, but on observing the opinions expressed by eminent authorities in favour of one scale and in opposition to another, I cannot avoid the conclusion that those opinions have been based on partial views, restricted to particular uses, and cannot be accepted as affecting the great question of a National Survey.

I agree entirely with Colonel Dawson that such a moderate maximum scale should be adopted as should not greatly exceed the requirements of any known purpose for such scale; and for the sake of simplicity and economy I would therefore eliminate some intermediate scales in the complete list that might otherwise be useful for certain purposes, recourse being had for them to the next highest in the range; but I do not believe that all the great purposes which a national survey should command can be adequately provided for with less than four scales, namely, 1-inch, 6, 24, and 120 inches to the mile.

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With regard to the 120 inches, or 10-feet scale, I had the honour of laying before your honourable Board, when the scales to be prescribed under the Public Health Act were under consideration, a statement of the various valuable purposes for which such plans of towns would be applicable, and it fully appeared that the scale which would be large enough for sanitary improvements would subserve all other purposes for which these plans would be so important. I then attempted to show that the practical value of such plans in a great part depends upon the opportunity which may be afforded for applying separate copies of the plans to the different classes of work which it is required to delineate upon them. This consideration leads to the question of engraving, upon which I shall beg to remark presently, but the question of scale is somewhat involved in it. At Liverpool the Ordnance 5-feet plan being found inadequate, a new survey was determined on to a scale of 20 feet to the mile, but the attempt to put every class of information as to improvement works upon the same copy, caused a confusion of plan which no increase of scale would have avoided.

With reference to the proposed adoption of the 2-feet scale in a national survey, I speak with great confidence of its importance for general plans of improvement works of towns, and surrounding neighbourhoods. Nothing can be more satisfactory and decided than the practical experience upon this point under the Public Health Act, and if such a scale should not be adopted as an integral part of the national survey, a great public want would be left unsupplied, which would still call for repeated separate surveys for these purposes.

From long previous experience I can vouch for the general advantage of the 3-chain scale (which is practically nearly the same) for the admeasurement and calculation of areas, and for all purposes affecting land; but I am aware how little my testimony can give weight to the conclusions of Colonel Dawson on this point. Different views are expressed by some parties, but the opinion of no man living ought to be taken in opposition to Colonel Dawson's experience on this subject.

For estate plans and sale and transfer of property, for tithe commutation, inclosure, parochial assessment, mineral surveys, there is ample evidence, in addition to that of Colonel Dawson, that a less scale would not be so efficient, and I can only regard the opinions expressed by some of the engineers consulted, against even the smaller scale of 12 inches to the mile, as having been based on their own immediate experience of the advantage of the 6-inch for special purposes; and not, as expressed in Sir C. Trevelyan's letter to them, with reference "to all the purposes which a national survey should be expected to subserve."

I must admit that the 12-inch scale, for the general plan of the metropolis, was adopted upon my recommendation; but this was an exceptional case altogether, and the arguments in its favour would be no guide for the general adoption of this scale. This plan was already executed by the Ordnance on the 5-feet scale, which would be available for such purposes as the 1-foot would not accommodate.

Satisfied as I am of the necessity of some large scale, such as 2 feet to a mile, as an integral part of the national survey, I cannot at all coincide with the views of those who would desire to *substitute* this scale for the 6-inch scale. I am convinced that all the purposes of this great work cannot be subserved by such a course. It almost speaks for itself that the interval between 1 inch and 24,—the area of the one being 576 times that of the other,—is so wide, that very numerous intermediate wants must be left unprovided for. The graduation would be destroyed at the most important part of the progressive arrangement.

I cannot agree with Major Larcom that this scale has fulfilled all the purposes to which it has been applied in Ireland, for in the absence of a larger

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scale it has constantly been applied to purposes for which it was never intended, and is not suitable; and Colonel Dawson very clearly shows that had these purposes been originally contemplated, a larger scale would in all probability have been adopted. Major Larcom, however, states very truly, "I know it is said by those who oppose its adoption in England and Scotland, that it is not large enough for an estate map, and too large for a general map; and this to some extent is true, but it is not meant for either."

Mr. Charteris says, "six-inch maps would indeed appear to be either too large or too small." It is perfectly true that for certain purposes they are so; but that fact by no means destroys their immense value for other purposes, in which the whole nation is directly interested, and for which neither the 2-feet scale on the one hand, nor the 1-inch scale on the other, would be conveniently available.

The chief purposes subserved by the 6-inch scale are of an engineering character. While some parties complain that it is too large, and others that it is too small, there is a very general testimony from engineers in its favour, which would deserve consideration even if the importance of this link in the national survey were not otherwise so manifest.

Colonel Dawson, when giving his reasons in favour of a larger scale, remarks: "I do not, of course, mean to say that no benefit whatever would result from the 6-inch map. Where no plans on a larger scale were found, the public would of necessity use it, or seek to make it available. It would, doubtless, also be used to a certain extent for preliminary surveys for railways and other engineering works; but this might possibly be only partially benefiting a particular interest at a great cost to the public at large." It must be borne in mind, however, that this was written when contending for the superior advantage of a larger scale in *substitution* of the 6-inch. I should have great confidence in obtaining Colonel Dawson's acquiescence in the sufficient importance of the 6-inch scale, when proposed in addition to the 2-feet, and more particularly as I hope it may prove that both may be adopted, under suitable conditions, without any serious addition of cost; but if this should not be Colonel Dawson's individual opinion, I am quite sure that he would desire that the testimony of the civil engineers should have full weight and consideration upon this point. Even if the advantage of the 6-inch scale should be exclusively confined to engineering operations, I cannot admit that this should be viewed as "benefitting a particular interest." The 6-inch scale will be especially valuable as the intermediate work upon which, besides the general features, the physical relief of the country may, under improved arrangements, be fully and truthfully represented, and it will thus serve for the preliminary laying out of general engineering schemes with a facility and accuracy that cannot be otherwise attained: roads, railways, inland navigation, general drainage, sewers and conduit of water supply, general irrigation, improvements of large tracts of land, and other works. Upon all these questions of general national importance the engineer is the representative of the public, and what affects his convenience and facility of operations, affects likewise all classes having jurisdiction or interests in works or property.

In the preparation of schemes for Parliament, for deposits, standing orders, and committees, the extension of this scale will be most serviceable, and effect a large saving of money. For purposes of the Public Health Act, in cases which have extended so far beyond the immediate town district as to render the 2-feet scale inconvenient, it is also found extremely useful.

Mr. Charteris lays stress on the inconvenience of the scale for a *general* map, because of its cumbersome size when put together; but this opinion is also given on the supposition of its being *substituted* for the 1-inch scale, and in such a case the opinion would have weight. There can scarcely, however occur in this country at the present day any proposal of engineering works, affecting a larger extent of district than could be conveniently put together in one map on the 6-inch scale, or at most in two convenient divisions, and if there should, there will still be, as now proposed, the 1-inch map for the first stage of the proceeding.

Although I would lay great stress on the importance of the 6-inch scale for the public use, it is a point for consideration whether the whole country should not be surveyed and laid down in draft to the 2-feet scale, except perhaps such an extended area of Scotland as referred to by Mr. Charteris.

The basis would then exist, good for all time, for any additions and alterations that the future may bring about even on barren wastes. I would say of the 2-foot scale for the general survey, what Major Larcom expresses as his experience of the 6-inch scale. "In Ireland (parts of Mayo, for example) we had many square miles of bog and waste not worth laying down on the 6-inch scale, if they had to be done alone, but so mixed throughout the country, that it would absolutely have been more expensive to have set men to survey and draw them on a smaller scale than to sweep over them with the great machinery in common with the rest of the country."

The opinion which I have now ventured to express as to the scales for public use which are indispensable for any complete national survey, may be shortly summed up as follows:—

The 1-inch scale of the whole kingdom, as already assumed.

The 6-inch scale of the whole, except extensive mountainous and unimprovable districts.

The 24-inch scale for the cultivated, improvable, and populous districts extended over all those parts of the country to which the 6-inch would not generally be adequate for the actual admeasurement on the plan of the separate field areas or divisions. The 120-inch scale for town areas.

The extent of country over which it would be desirable to carry the 6-inch and 24-inch scales respectively would no doubt be best determined by the Ordnance Survey Department; but probably the proportion of population to the area presents the surest guide for fixing these limits. The 120-inch scale I have reason to consider should be extended to all towns and places numbering 500 in population.

I regret that I should appear to differ somewhat with the views expressed by Colonel Dawson on these points; but the question of difference is really as to the engraving only. I should hesitate to give an opinion at all, at variance with his views, were it not that the experience recently obtained under the Public Health Act has a most important bearing upon this part of the subject, and that I have great confidence that on full consideration Colonel Dawson will admit the great weight of this experience, even if he cannot fully agree with my recommendation.

Colonel Dawson proposes that the draft plans shall be executed on the scales of 24 and 120-inches to the mile, but that they should be engraved for the use of the public to the scales of 12 inches and 60 inches to the mile respectively. Now, the great public value of a national survey at the present day appears to me, as I have before stated, to consist in the opportunity afforded for supplying its results at a cost within the reach of all by means of engraving. If, therefore, the scales to be adopted for the draft plans are those best suited for the public requirements, I cannot see the object of furnishing the public by means of the engraving with a less and insufficient scale; and I must unhesitatingly express my opinion that the main public purpose of this great work would be defeated by such a course. The engraving is, in truth, the chief consideration with the public. The scale of the draft plans would be of *public* importance only in the absence of the engraving, and then only to those few who could afford to pay for manuscript copies of the original plans.

The proposed scales of the engraving being admittedly only half those which would best subserve the various purposes of a national survey, it would in reality become practically of little use, for manuscript copies would still have to be sought; and where only a few copies of the same plan would be required, we have in the experience of the Public Health Act an apt illustration of the effect which would follow. I have already said that the 5-foot Ordnance plans (the scale proposed for future engravings) being wholly insufficient for the purposes of the local boards, copies of them have been obtained, and then enlarged to the required scale. Independently of all other purposes to be subserved by engraved plans, great facilities are obtained by the possession of several copies of the plan in the execution of town improvements, so that even in towns of only a population of 4,000 or 5,000 it has been found by the local boards to be an economy to have this enlarged plan *lithographed* at their own expense, for to do this has cost them little more than the charge for two traced copies of the Ordnance insufficient plans.

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And thus it will be for the future, if inadequate engravings are offered to the public, wherever a few copies are demanded, that requirement will be locally fulfilled which it should be the primary object to accomplish nationally.

Mr. Griffith explains that the origin of the 6-inch map of Ireland being engraved was, that he required six copies, which Colonel Colby ascertained would fully equal the cost of laying the work down on copper.

Colonel Colby remarked in 1840: "In the drawing-room the difference of cost, due to difference of scale in the outline plotting and drawing, would not be of sufficient amount to form any argument in favour of a scale inadequate for the purposes of the country." With how much greater force this may be said in 1853 of a scale of engraving inadequate for the purposes of the country.

It is a question for inquiry and consideration, however, whether the engraving of the national plans to the three scales, as I venture to propose, of 6, 24, and 120 inches to the mile, would entail any such material increase of cost as to form an objection in so great a work—if it be considered on the one hand that the 6-inch and 24-inch engravings would extend only to those parts for which these scales would be suitable, and that on the other hand the 12-inch scale would extend over the whole country alike. But if the extra cost *should* prove to be considerable, so strongly do I feel to be the public importance of the proposal, that I would respectfully urge that the question should not be decided without the fullest investigation. I must repeat my opinion, that if the results of the national survey should be engraved on the 12-inch and 60-inch scales, its main public value would be destroyed; but I can speak with confidence of what I know, that at least for the purposes of the Public Health Act and sanitary improvement generally, it would fail in its chief point of usefulness.

This report has extended much beyond what I had anticipated; but I venture, nevertheless, to add in a supplemental paper a few further observations upon the system of contours, the engraving of town plans, and the modes of execution of the work, which appear to me to be not irrelevant to the inquiry.

In claiming attention to a proposal of a system of progressive or graduated scales for the national survey, I fear I have not been able to do justice to so important a question. I have the greater confidence, however, in the soundness of the views submitted, from the fact that they appear to reconcile opinions of the eminent authorities consulted which are otherwise conflicting, and to satisfy the public requirements expressed by all.

SUPPLEMENTAL STATEMENT.

Contours and Levels.

The great importance of the question of the accurate representation of the physical relief or variations of surface level of the country, and the differences of opinion that are expressed in the letters on this subject, induce me to offer a few remarks thereon for consideration.

I perfectly agree with Colonel Dawson that it would be quite impossible to bring out a correct representation of the features from the mathematical contours alone, in whatever way they may be dealt with on the 1-inch scale; but I am not therefore prepared to join in Mr. Charteris's recommendation, "Of putting an immediate stop to the system of contouring."

The fact stated by Mr. Vignoles, that this operation has been considered by all minor states of the continent an indispensable portion of their national survey, would be alone worthy of much notice; but the experience of the utility of contours in this country will no doubt induce the Government to hesitate in their abandonment.

I would strongly urge, however, that a stop should be put to the system as now practised by the Ordnance Survey Department.

I will beg to quote the following statement upon this subject, which I had the honour of laying before your honourable Board in a report upon surveys in 1849:—"It may be useful to remark also on the erroneous practice of attempting to exhibit a system of contour lines at all on large scale town plans. Accuracy of level line under such circumstances is an impossibility, it can

“ only be an assumption, for it can be traced only for the most part over the thoroughfares and public places which form but a fourth of the whole surface, and which in very many instances being artificially raised, give a false representation of the natural surface variations. Such an employment of the system would appear to be at variance with its true object, and to mislead rather than to secure any useful result.”

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“ A system of contour lines on small-scale maps from which a general view of a district may be obtained, is a most valuable adjunct, as affording at the same time a complete conception of the variations of surface level, and facilitating an accurate judgment on the broad principles upon which the works of improvement should be carried out; but on detailed plans they are of no avail for such a purpose, and as they can have no traced existence on the ground to which reference could be made in the practical execution of works, they are worthless.”

“ As the actual value of contour lines is therefore in reality of a general rather than a minute character, it becomes important to consider further how far the utility of the work warrants the excessive cost and the great labour and minuteness involved in their execution, and whether equally good results may not otherwise be more economically realised.”

It has already been remarked that contours would not give an accurate representation of the features upon the 1-inch map. A *medium* scale is required for their proper exhibition. The 6-inch appears to me rather a maximum size for this purpose, but as their great value is already practically realised upon that scale, and it has already proceeded so far, this affords, to my mind, one of the great reasons for its continuance.

It would still remain to be considered, however, whether some modification may not be adopted to reduce the excessive cost of the operation, and at the same time render the information more complete.

In the early practice of contouring an estimate of its cost was furnished by the Ordnance to the Health of Towns Commission, of 1*d.* per acre without the towns, and of 5*d.* per acre average within the towns, on plans to the 5 feet scale.

In an estimate for filling in the survey around the metropolis, with the view to a complete plan on the 12-inch scale, three-fourths of the area being of a suburban and rural character, the cost of contouring was calculated at 9*d.* per acre. The whole cost of the filling in survey, without contours, was estimated at 9*d.* per acre also, so that the contours would have just doubled the expense of the complete survey.

Such being the enormous cost of this operation as now conducted minutely, the information at last being imperfect, and its utility of a general and not of a minute character, I would venture to submit two suggestions: 1. That as an extended and complete system of permanent fixed points of level, which would always be of practical service for reference on the ground, might be obtained at considerably less cost than the present method of contouring, whether these might not be added with advantage, and the contours modified and reduced. 2. That as contours fail to convey an accurate representation of peculiarities of surface, whether a system of hill sketching founded on Mr. Dawson's method might not be added, from which a better general view of the natural surface variations would be obtained.

It appears to me probable that with this combination and less elaborate contouring, a better popular notion of the physical relief of the country would be conveyed, and a more useful map at the same time secured for the professional man with little or no extra cost.

While upon the question of the levels, I would beg to add my humble testimony to that of Sir Roderick Murchison, of the importance of adding to the 1-inch maps “ the height of every principal mountain, hill and valley,” and I would insert also such of the prominent bench marks from the larger plans as could be conveniently added for the purpose of connexion and reference.

Instead of contours on the larger plans, I would attach to each fixed point of level (now shown by a dot only with the figured level) some symbol, which would indicate the direction and extent of the variation of surface from such point; as for instance thus:



for falling ground, the direction of the

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greatest and least fall being indicated by the greater or less angle of the arrow head ; thus, $42^{\circ}20'$  for level ground in each direction ; thus, $95^{\circ}61'$  for a summit level ; thus, $10^{\circ}43'$  for a lowest level.

Engraving.

Referring in my previous report in 1849 to the important public purposes, which would be subserved by engraved plans, on the 10-foot scale, it was stated : “ The chief value of an engraved plan on a large scale consists in the “ opportunity which it affords for multiplied and permanent usefulness in the “ various departments of service, the means being thus provided of noting “ down from time to time on separate sheets, the changes which in one or other “ department are perpetually recurring.”

And in objection to the Ordnance practice of exhibiting on their engraved town plans features which are subject to frequent alteration, such as gas and water pipes, it was added :

“ Not only is the chief value of the engraving thus cut off, but from the “ constant change that is thus taking place in these features, the information “ conveyed must be in many respects incorrect even before it is given to the “ public ; and it necessarily becomes from day to day less to be depended “ upon. The engraving of such plans at the present day would appear to be “ especially objectionable, when there can scarcely be a town in the kingdom “ in which the largest changes and improvements may not very shortly be “ expected, and which will put such engraved plans, exhibiting present arrange- “ ments of drainage, water supply, &c., quite out of date very soon after they “ are published ; and a vast expense will thus be rendered comparatively “ useless.”

It appeared to me that the engraved plan should contain the full amount of information which would be of use to most, if not the whole, of the various services to which it would be applied, and no more. That *every external feature* little liable to change, every house and building, with its number and class, and the fixed points of level, should be given ; but that, instead of being crowded up with special matters, as much clear available space as practicable should be left, so as to allow of the delineation of each particular class of information required to be inserted in manuscript, and which would form the foundation of a record, on separate sheets, from time to time, of the changes which are perpetually taking place in each department of works, and would provide a chronological series of statistical information of the utmost value and interest, which could not be acquired by any other means.

PRESENT MODES OF EXECUTION AND PROPOSED CONTRACT.

In submitting observations as to the importance and practicability of proceeding with the national survey on a more extended and useful scale, some points occur in the experience under the Public Health Act having reference to modes of execution of the work, to which it may be useful to invite attention.

The completeness of the arrangements and system of the Ordnance Survey Department, the means and appliances at their command, and the accuracy and beauty of their work, induced the opinion that the surveys under the Public Health Act would be executed most satisfactorily by that department. It was conceived that the private surveyors, being without organization, combination of appliances, or any fixed recognised mode of proceeding, however individually skilful and experienced, could offer no security that they would be enabled generally to compete with the Ordnance Department as to perfection of work, economy, or dispatch. Subsequent experience, however, has fairly led to a doubt, whether the full results which might be expected from the facilities and means at command of such an establishment are actually realised by the Ordnance system. Certain it is, that without these advantages equal results have been produced under the Public Health Act in point of accuracy and finish, with greater economy and less delay, by unaided individual skill and exertion.

I think it right to admit this in justice to the private surveyors of this country ; but at the same time I must beg to disclaim any intention of desiring to depreciate the Ordnance Service by such a statement. On the contrary, I would beg to offer my testimony to the admirable character of the work uni-

formly executed by them. I do not suppose for a moment that a better department could be organised for the superintendence and conduct of the great work of a national survey. It is their system which appears to me to be susceptible of improvement. It is admitted to be essentially a rigid mechanical system; their "men are like machines." "If," says Captain Yolland, "we were to do away with that mechanical operation we now use, we must bring in people who can think and act, and exercise discretion, and so on; therefore we must have a higher paid and superior class of assistants to those that we now have."

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Now, when it is found that unaided individuals who are of necessity compelled to exercise thought and discretion in every portion of their work can successfully compete with the organised arrangements and appliances of an important establishment, the question does present itself whether the infusion of a little more mind into the Ordnance system might not be attended with beneficial results.

In contemplating so great a change as that of laying down the national survey to a scale of 2-feet to a mile, I would venture to suggest whether a system of contracts by private surveyors for various portions of the work, might not, under certain stipulations and conditions, be grafted on the Ordnance arrangements, under their adequate superintendence and checks at the different stages of the work.

As a promise of superior workmanship to be obtained by the exercise of mind in the operations, Colonel Dawson shows that artistic skill and ability must be sought and exercised to realize the perfection of one portion of the work, hill sketching. As a proof of the economies to be expected from an infusion of the competitive system, I need only refer to the fact, that one of our first London engravers undertook to engrave the Ordnance 5-foot plan of the metropolis at one half the price at which that department had estimated that it would cost them executed at their establishment.

Colonel Colby in his historical retrospect of the Ordnance survey in his report of 1840, alludes to the insufficiency of a former system of contract plans, and the trouble, delay, and unsatisfactory result of the steps taken for revising and correcting them. I am not aware of the character of those plans, but they would not appear to constitute in any way a parallel case to the system which is here suggested. No basis would seem to have been provided for the construction of those plans, or means of superintending or checking them as they proceeded; they seem to have been examined only on completion, when a satisfactory result was not much to be expected.

I should have great hope, that under a judicious system, the work would be materially expedited also by this process, and it is even possible that Colonel Dawson might be in a position to vouch for the accuracy of a considerable amount of work already executed, under the regulations of the Tithe Commission, which might be made available. I can myself speak for the detail surveys of several towns under the Public Health Act, already prepared by private surveyors, which will bear the test of any fair examination, and in point of accuracy would not be a discredit, side by side with Ordnance work.

I have, &c.

HENRY AUSTIN.

No. 117.

MR. JOHN McMILLAN.

RECOMMENDED.

Inches to a mile.

For the draft plans of rural districts to be preserved as public records

For the plans to be engraved for sale - - -

For the draft plans of towns for record - - -

For the plans of towns to be engraved for sale - - -

SPECIAL OBSERVATIONS.

Newton Stewart, October 26, 1853.

I HAVE carefully read over the correspondence and memoranda sent to me along with the foregoing letter, and I beg to say that, as agent on a land estate, I have found the maps on a 6-inch scale to be extremely useful, and to serve in many respects the purposes of estate plans. The maps would no doubt be still more useful, if engraved upon a scale large enough to give correct measurements of fields and divisions of the smaller size. But on this point I conceive the suggestion of Mr. C. Vignoles (Correspondence No. 8) to be fair

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and judicious: and I agree with him also on all other points, except that I should fear the contour lines would be too minute on the proposed 1-inch map, on which it might be better to indicate hills and undulations by shading.

No. 118.

THE STATISTICAL SOCIETY.

RECOMMENDED.

	Fraction of a mile.
For the draft plans of rural districts to be preserved as public records	·0004
For the plans to be engraved for sale*	-
For the draft plans of towns for record	-
For the plans of towns to be engraved for sale*	·0020

* Any sub-multiple of the above that experienced parties may think not too cumbrous and expensive to meet the public market and demand for the same, say ·0002 mile in the former, and, perhaps, ·001 mile in the latter.

SPECIAL OBSERVATIONS.

12, St. James's Square, London, November 5, 1853.

THE Council of the Statistical Society, having had under their consideration the circular letter of the Treasury, dated the 6th of October 1853, on the subject of the scale to be adopted in a national survey, are of opinion,—

(a) That in so great an undertaking as a national survey it is, in the first place, most important to fix on some simple, well understood, and clearly defined unit of measure, such as the mile, pole, or chain.

(b) The unit of measure having been properly determined and fixed on, it is desirable that every map, whether on a large or a reduced scale, should be in such relation to the unit of measure as to be expressed by an exact decimal equivalent, easily convertible into the popular denominations of quantities of land.

(c) It would appear from the various states in Europe, as well as from the opinion of men of great practical experience in this country, that a less scale than one ranging from about 24 to 27 inches to the mile would not suffice for the accurate delineation of the minute details so often required for practical purposes. If, then, the mile should be adopted as the unit of measure, the nearest fraction between the above limits would be $\frac{1}{2500}$, or ·0004 mile, which differs in but a very slight degree from the scale suggested by many authorities, but possesses the recommendation of assimilating all the calculations to a simple decimal system.

(d) The scales for towns should be double, treble, or some convenient multiple of the above fraction, ·0004 of a mile.

For almost all extensive statistical inquiries, maps of the kind now under consideration would be of the utmost value; and the growing importance of economic science does now imperatively demand the immediate completion of such a national survey.

I am desirous to call your Lordships' attention to the fact, that the date of the circular letter (6th October) precluded an earlier reply.

I have, &c.

F. G. P. NEISON, Honorary Secretary.

No. 119.

MR. JAMES W. HIGGINS.

Furnival's Inn, November 22, 1853.

IN regard to the inquiry what scales I would recommend "for any national surveys which may henceforward be carried on at the public expense," allow me to state, that I am not, nor have I been, much engaged in land surveying; my employments have been architectural, or, as it regards land, chiefly with building ground. I have, however, endeavoured attentively to consider the correspondence and memoranda forwarded to me, with a letter of yours, dated Treasury Chambers, 19th August 1853; my personal experience or knowledge is not, in this important affair, such as would induce me, satisfactorily to my own mind, to offer an opinion.

My general notion has been, and continues, that the 6-inch scale to a mile for the large map is not sufficient; but I believe that Colonel Dawson's letter, dated Whitehall Gardens, April 4, 1853, contains better reasoning and opinions than I can offer and, according to my humble judgment, the right views.

STATISTICAL CONFERENCE AT BRUSSELS.

[A STATISTICAL Conference, convened under the authority of the Belgian Government, was held at Brussels in September 1853, and was attended by statisticians and other scientific men from twenty-six States. The principal States of Europe sent delegates to the Conference, with a view of ascertaining what statistical inquiries were in progress, what improvements could be adopted, and, more especially, whether the inquiries could not be carried on so as to admit of ready comparison. The question of national maps and cadastres constituted one of the principal subjects for discussion. Mr. Farr was appointed to attend the Conference by the Registrar General, with the approbation of the Lords Commissioners of Her Majesty's Treasury, who directed him to draw up a report of the proceedings. The following extract from his report embodies the decision of the Conference on the question of the proper scales for national maps.]

EXTRACT from MR. FARR'S REPORT.

General Register Office, London,
21st October 1853.

Another great statistical desideratum in this kingdom is a map on an adequate scale. A large accurate map, on which all the varieties of surface, and every *separate portion* of immovable property, can be distinctly indicated, is the real basis of all the statistics of a country; and other maps, such as the Ordnance map of one inch to the mile, or maps still smaller, are also required for a great variety of purposes. Sir Charles Trevelyan placed in my hands before I went to Brussels the "Correspondence respecting the scale of the Ordnance Survey, and Replies to the Circular Letter from the Treasury, 1853," in which the question of the scale for national maps is discussed with great ability; and I had an opportunity, at the conference, of seeing specimens of the Bavarian map and cadastre, which de Hermann stated had cost 2,000,000*l.*, as well as the Belgian maps, which are on the same scale as, but in better condition than, the French maps.

The opinions of those at the Conference who construct, and of those who have occasion to use maps, were unanimous. It is stated as a fact, and laid down as a principle, in their programme and report, that the "field, or plot, is the fundamental element of the modern cadastre." *La parcelle est la base fondamentale des cadastres modernes.* And it appears to be well established, that the "parcels" can only be laid down accurately in ordinary circumstances on the scale of about $\frac{1}{2500} = (.0004)$ as it is commonly expressed on the Continent, or of $25\frac{1}{2}$ inches nearly to the mile, as it is often expressed here.

After referring to the triangulation and boundaries, the report says, "La partie d'art du cadastre comprend les travaux d'arpentage et le lever du plan parcellaire à l'échelle ordinaire de $\frac{1}{2500}$; mais pouvant aussi être, suivant les circonstances, de $\frac{1}{5000}$, $\frac{1}{1250}$, et même $\frac{1}{500}$ pour les localités où les parcelles sont généralement très petites."

The large atlas, it is added, should be accompanied by a reduced map on a scale generally of $\frac{1}{10000} = (.0001)$, but which *may be* either on a scale of $\frac{1}{5000}$ or $\frac{1}{20000}$.

The Irish map is on the scale of $\frac{1}{10000}$; it is therefore not the "plan parcellaire," but the reduced "tableau d'assemblage." In England the map of one inch to the mile may serve the purposes of the reduced map; the larger map, on the scale of about $25\frac{1}{2}$ inches to a mile, is the only new map required.

On the Continent a valuation is almost invariably connected with the survey and map; the "cadastre" includes both. It would appear, from the various papers which I have seen, that the following defects in the Irish cadastre greatly impair its utility and value:

1. Each plot is not so laid down that its contents can be determined from the map.
2. Each plot is not SEPARATELY valued.

3. What is called the *annual value* is not the value in the correct sense of the word ; as the average value of a thing is that sum of money for which it will, under ordinary circumstances, sell in the market. It is the net *average annual* rent, *multiplied* into the number of years purchase.

The scale which Colonel Dawson recommends, and supports with arguments which appear to be irrefutable, is nearly the same as that which is in general use for the cadastral statistics.

But it appears to me that all calculations and all comparisons would be facilitated by adopting the continental scales, instead of the modifications which are suggested in Colonel Dawson's examples.

Thus, for the general map, Colonel Dawson suggests the scale of 24 inches to the English mile, or $\frac{1}{2640}$, which differs inconsiderably from $\frac{1}{2500} = \cdot 0004$. The difference is slight, but upon the whole the latter scale is the simpler.

The scale of the whole country would be $\cdot 0004$ mile, that of the towns would be, by the same mode of expression, $\cdot 0020$ mile: a mile of territory would be represented by $\cdot 0004$ mile on the general map. The same fraction would be as applicable to any other unit measure as to a mile.

The want of decimal divisions of measures is as great as the want of decimal divisions of money, and leads to similar intricacy and confusion in calculation.

The committee which the Congress appointed to report on the subject, expressed the wish, that future cadastral maps should be constructed more accurately than those of the existing continental cadastres; and that these great national surveys should be undertaken with more extended views to the promotion of public, scientific, and industrial purposes,—which were not formerly contemplated; and should be subservient, not only to present uses, but to the exigencies of future times.

This sentiment, in the concluding paragraph of the report by M. d'Avila, was warmly applauded by the Conference.

“ Nous proposons finalement que le cadastre soit fait de manière à ce qu'il
 “ puisse, avec le temps et en vue des règles de la proscription, devenir le titre
 “ probant de la propriété; car nous ne voulons pas que le cadastre soit seule-
 “ ment un instrument fiscal; nous voulons que sa mission soit plus élevée;
 “ nous voulons que le cadastre soit l'inventaire de la propriété foncière du
 “ pays, le grand livre où chaque propriétaire puisse trouver les titres de sa
 “ propriété; nous voulons que le cadastre soit la base de la statistique du
 “ territoire, de la statistique agricole, du système hypothécaire, du credit
 “ foncier, et en un mot, de toutes les questions qui concernent la propriété.
 “ Nous entendons que sous ce point de vue, *l'organisation du cadastre est un*
 “ *des plus grands bienfaits que l'on puisse rendre à un pays.*”

LETTER from the MASTER GENERAL OF THE ORDNANCE to the TREASURY, with Reports from Lieut.-Gen. Sir John Fox Burgoyne, G.C.B., Inspector General of Fortifications; Lieut.-Col. Hall, R.E., Superintendent of the Ordnance Survey; Lieut.-Col. Tucker, R.E.; Captain Leach, R.E.; and Captain W. D. Gosset, R.E.

The MASTER GENERAL of the ORDNANCE to SIR CHARLES TREVELYAN, K.C.B.

Office of Ordnance, July 29, 1853.

On the receipt of your letter of the 19th April, enclosing printed copies of correspondence and memoranda relating to the scale of the Ordnance Survey, I deemed it right to place myself in communication with the Inspector-General of Fortifications on this important subject; and I have now the honour to transmit to you the result, in a letter from Sir John Burgoyne, dated the 26th instant, and a detailed Report from Lieut.-Colonel Hall, the Director of the Survey.

Letter from the
Master-General of
the Ordnance, &c.

In submitting these papers, with the accompanying maps, to the Lords Commissioners of the Treasury, I beg you will inform their Lordships, that for the reasons therein given, I fully concur in the conclusions which have been come to by the Inspector-General, in favour of the scales of six inches, and one inch, to a mile.

RAGLAN.

THE INSPECTOR-GENERAL OF FORTIFICATIONS to LORD CLARENCE PAGET.

Pall Mall, July 26, 1853.

To enable me to comply with the desire of the Master-General, dated 20th April 1853, for materials to answer a printed communication from Sir C. Trevelyan, dated Treasury Chambers, 19th April, respecting the scale for the Ordnance Survey, I have procured a Report from Lieut.-Colonel Hall, Superintendent of the Survey, dated 15th instant, which I enclose with its accompanying maps.

I consider it a very able document, full of interesting matter, well worthy of the consideration of the parties, whoever they may be, that it would seem must still have to decide upon this very debateable subject; some little appearance of harshness of expression towards opponents, it is to be hoped, will be excused on the part of one who is so thoroughly zealous and anxious on the subject.

My own opinion, which I would offer with great diffidence on a subject that may be viewed under so many aspects, is in favour of a perseverance in the six-inch scale as the large National Survey, and of a one-inch scale, the features and contents of which to be very carefully considered on specimens, for a more general Map.

My reasons are, that no map on a one-inch scale can possibly contain every *national* feature, but that the six-inch will; and I observe that the advocates for larger scales all ground them on requirements for *partial* objects, such as measurements of minute parts of landed properties and other details, rather of private than public necessity; and although the amount of these wants in the aggregate may be of national importance, it is submitted that they would not be of such general application as to justify so great an increased national expenditure, and the inconvenience of making them totally inapplicable to being put together for any purpose of general reference as the six-inch may be. Nor does it appear that any one scale would suit all these partial objects, unless it were on the largest requirement, which it would be preposterous to subject the country to, in order to meet that one.

There is a great body of evidence to show the great value of the six-inch maps; and it is no unimportant consideration that all Ireland, and some counties in England and Scotland, have already been completed, or are in progress on that scale, all which will have to be done over again by adopting a larger.

The question of the *contouring* is not adverted to in Sir C. Trevelyan's letter; but I trust that it will not be abandoned without further consideration. I entertain a very strong opinion in its favour against any other mode of delineating undulations of country.

J. F. BURGOYNE, I.G.F.

Letter from the
Master-General of
the Ordnance, &c.

LIEUT.-COLONEL HALL to the INSPECTOR-GENERAL of FORTIFICATIONS, forwarding a Report on the subject of the Scale, and method of representing the Hill Features, to be adopted for the Ordnance Maps.

Ordnance Map Office, Southampton, July 15, 1853.

In obedience to your Minute of the 22d on the Master-General's order of the 20th of April, and to your Minutes of the 4th and 10th May, I forward herewith my Report on the subject of the scale, and method of representing the hill features, to be adopted for the Ordnance Survey.

In treating these important subjects it has been my endeavour, not so much to advocate the peculiar fitness of any one scale or system, as to produce a full and impartial statement of the whole question, as far as lies in my power, so that the proper authorities may have the most complete information on which to decide; and this desire, together with the time necessarily occupied in preparing the specimens and collecting information, will, I trust, be a sufficient reason for the delay in replying to your reference.

LIEUT.-COLONEL HALL's Report on the Scale, and method of representing the Hill Features, to be adopted for the Ordnance Survey.

On the Scale.

Except by Lord Langdale's Commission of 1849-50, on the subject of Registration of Property, before which my executive officer tendered as the result of the experience of this Department, *an opinion in favour of a twelve-inch scale*, no inquiry has been made (since the correspondence in 1840-43 between the Duke of Wellington, the Treasury, the Tithe Commissioners, the Ordnance, General Colby, and various scientific and influential bodies) as to the desirability of adopting for the national survey of England and Scotland, a scale *larger* than that of six inches to a mile.

The Committee of 1851 on the Ordnance Survey of Scotland confined its attention, and that in a very limited manner, to the comparative merits of the six-inch and a *smaller* scale, and it was then shown that the six-inch scale was adaptable to many of the great public purposes for which a one-inch was utterly useless. This opinion (though Messrs. Stephenson, Locke, and others diametrically opposed it, and in certain points by evidence which I shall notice hereafter as being positively faulty) was supported by Sir John MacNeill, who had, as he told the Committee, *used* the six-inch maps with every success for *laying down thousands of miles for railways and other purposes*, and had invariably found them strictly accurate, so accurate that he could safely trust the cause of his clients on schemes founded on these maps (vide Report, Replies to Questions 1175 to 1196); also by Mr. Griffith, whose valuation of Ireland has been mainly based on the Ordnance six-inch maps; further by the opinion of the Astronomer Royal for Scotland, by Mr. Vignoles, a civil engineer of European celebrity, by Mr. Alan Stevenson, the eminent engineer for the Board of Northern Lights, and by other professional and practical men.

Convinced in my own mind of the superiority of the six-inch over the one-inch scale for *many* public purposes, anxious that the true interests of the public should not be sacrificed, and well aware that the people of Scotland could not be content with the one-inch scale after the great benefits of the six-inch map had been so fully experienced, I deemed it my duty, as Superintendent of the Ordnance Survey, to protest against the abandonment of the six-inch in favour of the one-inch scale, and suggested further inquiry into the question.

That I was justified in impugning the soundness of the Committee's decision with respect to the six-inch scale has, I think, since been amply proved by the numerous petitions from Scotland which *followed* that unfortunate decision,—petitions demonstrating the inadequacy of the one-inch, and praying Her Majesty's Government to restore the six-inch scale, and which caused the six-

inch scale to be again conceded to the counties of Fife, Durham, and Haddington; and the justness of my comments has been further confirmed by the many counties which, in reply to the *late* Treasury appeal, have (I observe by the public prints) demanded either a six-inch scale survey, or some scale larger than the one-inch.

Letter from the
Master-General of
the Ordnance, &c.

That the Committee declined to receive evidence from other engineers than those examined I have always regretted, as the waste of public money which has taken place in consequence of the Committee's report having been adopted in the south of Haddingtonshire, and the survey having since had to be again done on the six-inch scale, after having progressed (in accordance with the Committee's recommendation) on the one-inch, might possibly have been avoided had the Committee allowed Professor Gordon, professor of civil engineering in the University of Glasgow, and other professional gentlemen who actually were present, to give evidence, and whom my executive officer, both in writing and verbally, begged the chairman of the Committee to examine, but without success.

Great stress is laid by Mr. Charteris in the recent correspondence on the opinions and evidence of some civil engineers (who have scarcely used the six-inch map at all), whilst equal weight has not been given to the opinions of the civil engineers and others *who have used* the six-inch maps *extensively*. The evidence and opinions of Sir John MacNeill, Mr. Griffith, Mr. Vignoles, the Under Secretary of State for Ireland (Major Larcom), Mr. Rankine, Mr. Alan Stevenson, and others, are conclusive as to the great value of the six-inch maps, and the *sufficiency* of THAT SCALE *for many* important public purposes; and some civil engineers, whose letters are given in the correspondence, actually prefer the six-inch to even larger maps. Mr. W. Ranger, the well-known civil engineer to the Board of Health, thus writes: "In projecting works for Parliamentary purposes, I have made use of the contoured plans on a scale of six-inches to the mile, and found them extremely useful, every fence and house being delineated, so that the *saving in expense has been very great*."

The fact of the great number of purposes (use in constructing railways, roads, schemes of drainage, the sale of encumbered estates, valuation, &c.) to which six-inch maps *have been made subservient*, both in England and Ireland, shows the injustice, and disposes, of the remark made by Mr. Charteris, that those maps are "*practically useless*."

It has never been contended by the Ordnance officers that such maps answer *all* purposes for which maps can be required, but, that they subserve (in a greater or less degree) very many purposes for the Government and community, as shown by the letters and evidence detailing the various purposes to *which six-inch maps have actually been applied*. The recommendation to discard the six-inch for a one-inch map was opposed to the true merits of the case, and, if adopted, would inflict a positive injury upon the people of Scotland.

As before stated, the numerous appeals of 1853 from Scotland against the decision of the Committee, have forcibly borne out my views, and Mr. Charteris's suggestion of a larger scale (one 16 times the size of the six-inch map, which he has termed "cumbrous") cannot but be regarded as a tacit acknowledgment that the one-inch map alone, as I repeatedly urged, was totally inadequate to the requirements of the country, and the state of science in the present day.

In page 30 of this printed correspondence, Lieut.-Colonel Dawson endeavours to make light of the memorials in favour of the six-inch scale, by stigmatizing the Highland Society, the Literary and Philosophical Society of Manchester, and other public bodies to which he alludes, as ignorant of the subject on which they addressed the Government; but the combined talent of such bodies will, in the opinion of the public, be a sufficient refutation of this undeserved reproach, and must be considered of infinitely more weight than Lieut.-Colonel Dawson's single opinion.

The opinions expressed by these public bodies have also been supported by the late Major-General Colby, and by Major Larcom, Major-General Colby's able executive officer in Ireland, officers possessed of much greater general experience and scientific attainments than Lieut.-Colonel Dawson.

I now proceed to quote from some of the letters which were forwarded with my Report of November 1851, and which I think should, in justice to the Department, have been circulated with the late Treasury correspondence.

Letter from the
Master General of
the Ordnance, &c.

From SIR J. BURGOYNE, Inspector-General of Fortifications, one of the Commissioners of Sewers, &c.

"Hitherto their Lordships (the Treasury) have had before them the evidence of little more than on one side of the question, namely, for the reduction of the scale from the six to one-inch. There is little doubt but that the advocates for the small scale have, on a partial or imperfect view, greatly undervalued the utility of the larger map."

From C. VIGNOLES, Esq., C.E., &c.

"Kieff (Russia), July 6, 1851.

"The immense advantages which I have myself derived from the Ordnance Surveys of Ireland on the six-inch scale, as well as from the surveys of the northern part of England, as far as finished at the time, and especially from the levels marked thereon in various degrees of detail, have been so great that I entertain a sincere hope so advisable a system may be continued throughout the United Kingdom, and, on the other hand, the many difficulties I have experienced from the want of such materials make me still more sensible of their importance and utility.

"I would also instance, in Lancashire and Yorkshire, the extraordinary facilities I had for laying out four or five important lines of railways through districts of extreme difficulty and complexity, viz., between Lancaster and Skipton, between Blackburn and Settle, Blackburn and Bolton, Blackburn and Wigan, and between Hornby and Shap Fells, for all of which lines I was furnished with tracings from the then unpublished surveys by the special permission of the Board of Ordnance.

"Again, in laying out the railways through the kingdom of Wurtemberg, I was enabled, by the aid of similar surveys, on a large scale, to accomplish a vast deal of work in a short time and at a very small expense. In that country the levels were not everywhere completed, but when I came to the difficult junctions of the Wurtemberg railways, with those of Baden on the west, and of Bavaria on the east, the system of contouring levels adopted in those countries, especially in Baden, enabled me to solve with the utmost facility and despatch questions of importance at issue between the respective Governments, in a manner I could not otherwise have done in the satisfactory way I have reason to know was the case.

"I may add that the laying out of the railways in Saxony, by the engineers of that country, was greatly facilitated by the existing large surveys and contouring levels of that kingdom.

"In my humble opinion the great advantage of the Ordnance six-inch maps and contouring levels is, in their presenting a sufficiency of detail to enable any number of projects to be cheaply, quickly, and accurately investigated, and either determined upon or rejected, without parties being obliged to call in professional assistance of a high class; or, calling in such aid, such documents will furnish an experienced engineer sufficient data, without any further local or particular examinations. Nothing will better exemplify this than the use which has been made in Ireland of these surveys and levels, for their ordinary purposes, by the county surveyors; and also for the details of the draining operations of that country, on more than one occasion, I have myself been able from those materials to give conclusive opinions on the subjects of new roads to the Board of Public Works. In England and Scotland numerous useful improvements—each perhaps of a minor character in itself, but amounting in the aggregate to a vast amount of public advantage—will be attainable, if the operations so successfully commenced in the Northern parts of England, and so happily completed in Ireland, should be extended to the whole of the United Kingdom."

From J. W. LEATHER, Esq., C.E.

"Leeds, August 23, 1851.

"I have now to say that, for the purposes of a first run over a country for finding a line of railway, the one-inch-to-the-mile map would be much more convenient than that at six inches to the mile, but for the surveys for water-work purposes, which require greater minuteness and where small differences

“ of level are of more importance, or even in the after-proceedings of railway surveys, when it becomes necessary to fix the precise fields, or the part of a field, through which the line had best pass, the six-inch scale is vastly more useful. There is also this to be said, that if we want a small-scale map for the purpose of a general view, we can get it from the six-inch map by reduction, but we cannot get the six-inch from the one-inch.

“ Both would be highly useful in their places, but if we are to be limited to one, I am decidedly of opinion that the six-inch map is much to be preferred.”

Letter from the
Master-General of
the Ordnance, &c.

FROM W. MACQUORN RANKINE, Esq., C.E.

“ 30, Great George Street, Westminster,

“ June 11 and July 12, 1851.

“ After many years’ experience in the use of the Ordnance maps of Ireland on the scale of six inches to a mile, and also of those of England on a scale of one inch to a mile, and of county maps of Scotland (most of which are very accurate) on scales varying from three quarters of an inch to an inch and a half to a mile, I have arrived at the following conclusions with respect to the comparative utility of maps on those scales for engineering purposes :

“ For the purpose of exploring the country preliminary to the selection of the line of an engineering work (especially a railway) the most convenient scale is that of one inch to a mile.

“ This, however, is the only advantage which I have found that scale to possess, and it is in my opinion altogether outweighed by the very great advantages possessed in other respects by the scale of six inches to a mile.

“ The existence of maps on the larger scale enables an engineer to select the line and estimate the cost of a proposed work with a precision, and to compare the economy and other advantages of different lines to an extent which would otherwise be impracticable, except at the cost of an expense which the scheme at the outset may be unable to afford, or of a delay which may be fatal to it. I am convinced that much money has been saved in the construction of public works in Ireland, in consequence of the publication of the Ordnance maps on a scale of six inches to a mile, and more wasted in England and Scotland from the published maps of the greater part of the country being too small to be used for any purpose except that of a preliminary exploration, and that unless the maps of Scotland are published on the larger scale the public will not reap that benefit from the survey which they are entitled to expect.

“ Sir John Mac Neill having been applied to in 1840 to report on the best means of protecting and draining an extensive district which was flooded every year by a large river, sent me to the locality to obtain the necessary information.

“ Being in possession of the Ordnance maps on a scale of six inches to a mile, a moderate extent of levelling and boring was sufficient to complete the data for estimating the cost of two different schemes for improving the river and ascertaining the extent and nature of the land which would be protected from floods by them.

“ Had those maps not existed, or had the scale been only one inch to a mile, our operations must have commenced with a survey of about forty square miles of country, the expense of which would have been more than sufficient to deter the landowners, at whose instance the report was made, from taking any steps in the matter.

“ I could cite several additional instances of the utility, and indeed necessity, of the Ordnance maps of Ireland in cases of drainage and river improvement projected by landowners, but as they were all similar to the above it may stand as a type of that class of examples, and I shall now describe one of a somewhat different kind.

“ A project having been formed in 1841 by a body of subscribers to reclaim about 30,000 acres of land from the sea, and execute at the same time improvements in a large and important harbour, it became necessary to select the lines of works and complete the Parliamentary plans and sections in the course of a single month, that of November.

“ The proposed works extended over detached portions of the coast of two counties. This, which without the aid of the Ordnance maps would have been impracticable, was accomplished with a little exertion in a satisfactory manner.”

Letter from the
Master-General of
the Ordnance, &c.

From ROBERT MALLET, Esq., Memb. Inst. Civil Engineers, M.R.S.A., &c.

" London, July 14, 1851.

" Had you not told me that some men having eminent names had given their opinions against such a map I could not have conceived it possible that its extreme value and importance could be for a moment doubted by any sane and unprejudiced person acquainted with the conditions of the question.

" I cannot expect that my name should be held as any authority upon this question, and while I hold an opinion most diametrically opposed to those of 'the authorities' you mentioned, I am myself accustomed to be little swayed by authority in such a matter at all: those who are, however, might easily find that such men as Dr. Robinson, Dr. Lloyd, Stevelly, Apjohn, and, in the practical walks of Science, every engineer in Ireland, would give but one opinion in favour of a six-inch contour map."

From C. PIAZZI SMYTH, Esq., F.R.S., London and Edinburgh, Astronomer Royal of Scotland.

" 1, Hill-side Crescent, Edinburgh, June 26, 1851.

" In reference to the scale on which the Ordnance map should be published, as the proposal to reduce it from six inches to a mile down to one inch to a mile appeared to me, from the very first, such an intense absurdity, such a decided case of retrogression to the dark ages, that I immediately took some trouble to inquire what were the reasons brought forward by the advocates for the alteration, and have found them, to the best of my knowledge, and to that of every one else to whom I have spoken, to be altogether erroneous in their foundations, and untoward in their conclusions.

" For hydrographical purposes the six-inch scale is preferred to the one-inch."

The following is from CAPTAIN OTTER, R.N., who has used both scales:—

" Loch Alsh, June 27, 1853.

" For the examination of rocks and intricate parts of the coast, I much prefer the six-inch to anything smaller—there is sufficient space to enter a number of soundings, and show any inequality of the bottom.

" The one-inch scale is too small for anything except off-shore soundings; and when used for a close examination it leaves no satisfactory feeling in the mind that the work has been thoroughly done. I may mention that, whilst surveying L'Shiel, Horun, and part of Lumbosh, I strictly examined the coast line by eye, as well as by angles, and it was a source of much astonishment to all of us how such a dangerous and precipitous coast could have been laid down with such accuracy."

Such is the evidence of practical, impartial men, and it is fit that I thus quote it in support of the assertions I have made as to the unsatisfactory nature of the Committee's decision; but, though I have thought proper to thus refer to the great value of the six-inch scale for general and engineering purposes, I have never implied that the six-inch map will suffice for *all property* purposes.

Before proceeding, however, to discuss a larger scale, I must first show that even in property purposes the six-inch may be applied in no small degree. Mr. Charteris (page 20) would seem to suppose that country gentlemen could more easily lay out a road by a one-inch than a six-inch map:

Thus writes ROBERT VANS AGNEW, Esq., a large proprietor in Wigtownshire:

" Barnbarroch, May 8, 1851.

" We, in this county, having our survey complete, may, I think, be considered impartial judges for the rest of Scotland.

" For all matters of property, boundaries, fences, roads, &c., it is not the least too minute, but is the most valuable and best reference and record a man can have. If the scale were reduced to one inch it would bring the map into one thirty-sixth of the space, and then, though exceedingly accurate, it would be little more than an index map. It could be of no use in fixing the exact lines of boundaries, &c.

" I should be very glad if you do engrave and publish a map of this county on the scale of one inch to the mile, for we have no good map, and it would be

“an excellent index, and would, I think, have a considerable sale in the county; but I should wish to have it in addition to, not in place of, the larger survey.”

Letter from the
Master-General of
the Ordnance, &c.

“I hope you will convince the Committee that the large scale is the best.”

And thus writes Mr. VIGNOLES, C.E. :—

“To landed proprietors in general, and to the owners of large estates in particular, especially when situated in remote districts, and not in the best state of cultivation, the six-inch maps of the Ordnance and the contour levels will prove of great value. The land steward, with or without the aid of a very ordinary country measure, would be able to lay out new roads and drives, complete drainage, procure water, divert streams, and generally carry on improvements on the estates, without calling in superior professional men; and he would be able to do all these with certainty that he has accurate data to go upon; and county magistrates may decide on new roads and other objects. For such purposes alone I think the operations should be persevered in as measures of great public utility.

“There are thousands and thousands of acres of land in Scotland and England that might be improved by a proper general system, or groups of systems, of drainage, but which can never be properly and economically done without a perfect knowledge of all the undulations of the country, and of all the various degrees of outfall, which the contouring system, on maps of a large scale, can alone give, and which the expense of doing by piecemeal, under the (unavoidably costly) direction of civil engineers, will deter proprietors from attempting, either individually or in associations.

“I am satisfied that, in most cases, Committees of Parliament could be able to form impartial and just decisions if they had some undisputed authority to refer to. Surveys on a large scale, with contouring levels of an authentic character, are so simple, so explicit, and clear in themselves, and so readily understood, that if such existed everywhere, then, in future, few, if any, questions involving comparisons could be subjected to much mystification before a Committee.

“I consider the six-inch Ordnance maps and contour levels to stand in the same relative position to the public in general, and to the profession of the engineer and surveyor, that a general system of registration of deeds does to the same public generally, and to the legal profession in particular. In the latter case, the lawyer profits by the absence of a general registry, while the public suffers. In the former case, the whole body of landed proprietors and improvers pay a tax, more or less, to the engineers and surveyors of all grades, for the want of a grand general system of mapping and levelling.”

Captain W. Driscoll Gosset, R.E., cites a case in which its usefulness in a *very considerable degree* for the registration of property is apparent. Every single property as then existing in 65 square miles of a portion of Wigtownshire were registered by him on the six-inch map, aided only by eight enlarged sketches of minute holdings. A scale that will admit of this is certainly nearly large enough for an index map for the Registration of Properties.

Professor Hancock, LL.D., Professor of Political Economy in the University of Dublin, in 1849 wrote a paper in which the six-inch survey of that kingdom was recommended as the basis for a general register of deeds, &c. &c.

Considerable argument is entered into as to the areas obtainable from six-inch maps. And here again it is manifest that that scale is undervalued, partly from want of experience in its use, and therefore of ignorance of its capabilities.

Mr. Griffith, however, writes that he has founded his valuation of Ireland entirely upon it, excepting when inclosures contained less than an acre; this is a *fact* founded on the largest use of six-inch maps ever known.

Lately I was applied to for the areas of the tenements in a township in Yorkshire; they were computed entirely (without the aids from calculations with chained lengths) from paper, and though the enclosures were almost all bounded by a stripe of water, which of course increases the difficulty of the process, the summation of 418 separate areas thus obtained, varying from 216 acres to 1 rood 8 perches each, and amounting in all to nearly 7,000 acres, was within $\frac{1}{100}$ of the true area of the township.

Letter from the
Master-General of
the Ordnance, &c.

The fact is, that properly constructed maps, properly handled, will afford better results than imperfect maps on a larger scale, which do not afford the means for being equally well handled.

But, though vindicating the merits of six-inch maps, as in justice to the importance of the subject I am bound to do, I am yet quite sensible that, for property purposes, the six-inch is (though *partially* applicable) not *fully* adequate, and it is with much satisfaction that I find the suggestion of a twelve-inch scale, as expressed by my executive officer before Lord Langdale's Commission in 1849-50, (vide Replies 1647 and 1661,) resuscitated by Mr. Charteris, and now brought more prominently forward.

The scale most adapted for general engineering and statistical purposes is the six-inch: increasing or decreasing this scale diminishes the *general* applicability of the map.

The question therefore is, what is the scale that shall fulfil all property purposes, and yet not destroy the map for other general and nearly as important measures.

After a very full consideration of the whole of the purposes for which public maps are now and may be hereafter required, I am decidedly of opinion that the twelve-inch is the best scale to be adopted for a general map of all the arable rural districts of the kingdom; villages and towns to be on exceptional scales of two feet, five feet, and ten feet to a mile, according to the nature of the place.

In thus adhering to the Ordnance Survey proposition of 1849, I differ from the view taken by Mr. Charteris, founded, as he intimated, almost solely on the opinion of one person (Lieut.-Colonel Dawson), as I propose the twelve-inch for the manuscript as well as *published* plans, whereas Mr. Charteris proposes a twenty-four-inch office plan, to be reduced to twelve-inch for publication. My reasons are—

1. I demur to the idea of hoarding up perishable paper documents, which time and even occasional use must eventually destroy, and which accident may annihilate in a few hours.

Hoarding up perishable paper documents is faulty in principle, and also opposed to the spirit of the day.

2. In order that the Public should receive the full benefit of the National Survey, on whatever scale it is plotted and drawn, on that should it be published, as all persons requiring copies could then obtain impressions at a trifling cost, instead of having to pay the expense of making copies or tracings from the original plans; and publication enhances the legal value of any document.

3. Whatever be the scale of the published plans, those are the plans the public generally will use, not the manuscript tracings. Persons who may require twenty-four-inch plans will be the exceptions. The national survey should be guided by the wants of the many, not of the few; therefore, let those who require twenty-four-inch plans pay for the plotting them on this scale. Thus will the great cost of plotting and drawing the whole country on the twenty-four-inch scale, and reducing it to the twelve-inch scale, be saved to the nation, and the progress of the survey be expedited.

4. By making the draft plans upon a different scale from that upon which they are intended to be engraved for sale, an intermediate troublesome operation is involved, and there can be no question but that plans plotted directly upon a scale of twelve inches to a mile will be more correct, than if reduced from working drafts of four times that size.

5. The scale of twenty-four inches is unnecessarily large for the draft plans of a whole country. Although Mr. Charteris, at Lieut.-Colonel Dawson's suggestion, recommends it, he does so on the supposition that it is the smallest from which areas can be accurately taken. But this is an error; for in dealing with maps constructed trigonometrically, and drawn with proper neatness and skill, the twelve-inch scale will give most excellent areas; far better areas indeed than the first-class tithe plans with which the Tithe Commissioners have hitherto been satisfied.

Since the receipt of these papers I have caused a few experiments to be made in taking areas from the paper on the twelve and twenty-four inch scales.

I subjoin the results, which (though made by persons not habituated to the use of the sliding scale) are sufficient to show that the twelve-inch map is very ample for obtaining areas, and therefore for property purposes generally in

ordinary rural districts, and if aided by trigonometrical calculations (for these experiments have been purposely done, irrespectively of the trigonometrical aids), the results are as accurate as the conditions of expansion and contraction of paper and unavoidable errors of manipulation will permit; and it is of no avail to seek for an atomic result in a matter involved with disturbing causes of much larger amount than the molecular fractions sought.

Letter from the
Master-General of
the Ordnance, &c.

TOWNSHIP OF BARKSTONE.

(Each plan being plotted not reduced.)

COMPUTATIONS from Paper on the 12 and 24 inch scale, compared with the Registered Areas.

Detached portions of the Townships in the interior of Barkstone.

	Registered Areas.	Areas from 24-inch scale.	Difference between the registry and 24-inch.	Areas from 12-inch scale.	Difference between the registry and 12-inch.
Little Fenton - -	0 2 1	0 2 0	+ 0 0 1	0 2 2	- 0 0 1
Church Fenton - -	0 3 38	0 3 34	+ 0 0 4	1 0 0	- 0 0 2
Biggin - -	0 2 2	0 2 6	- 0 0 4	0 2 0	+ 0 0 2
Barkstone, No. 1. - -	49 1 39	49 2 8	- 0 0 27*	49 1 35	+ 0 0 4
" No. 2. - -	25 0 25.5	25 0 31	- 0 0 5.5	25 0 24	+ 0 0 1.5
" No. 3. - -	4 0 9.5	4 0 2	+ 0 0 7.5	4 0 14	- 0 0 4.5
" No. 4. - -	13 0 38	13 1 2	+ 0 0 4	13 0 36	+ 0 0 2
" No. 5. - -	2 3 35	2 3 30	+ 0 0 5	3 0 0	- 0 0 5
Total area of detached portions†	96 3 28	97 0 13		96 3 31	
Total area of township minus detached portions.	1,069 1 7	1,068 0 0	1 1 7	1,068 2 0	0 3 7

* Some coarseness in plotting, not however correctable, probably causes this difference; or it may be expansion of paper, the space being so large on this scale.

† These areas generally are in favour of the 12-inch scale, which has probably occurred on account of the sudden changes in the weather altering the paper irregularly, in which case the larger the scale the greater would be the probability to give incorrect results.

EXPERIMENT in Computations from Paper (Irregular Enclosures).

Areas obtained by the Computing Scale from the attached Tracings.

Numbers of Divisions.	12-Inch Computations.		24-Inch Computations.	Difference.
	A. R. P.		A. R. P.	
1	0 0 13½		0 0 14	- ½
2	0 0 17½		0 0 17	+ ½
3	0 0 11½		0 0 11½	0
4	0 0 14		0 0 14½	- ½
5	0 0 22½		0 0 22½	0
6	0 0 23½		0 0 23½	0
7	0 0 15		0 0 15½	- ½
8	0 0 18		0 0 17½	+ ½
9	0 0 25		0 0 25½	- ½
10	0 0 35		0 0 35½	- ½
11	0 0 15		0 0 15½	- ½
12	0 0 16		0 0 15¾	+ ¼
13	0 0 22		0 0 22	0
14	0 0 16		0 0 15¾	+ ¼
15	0 0 23½		0 0 23½	0
16	0 0 20½		0 0 20½	0
17	0 0 14		0 0 14	0
18	0 0 17½		0 0 17½	0
19	0 0 21½		0 0 21	+ ½
20	0 0 20½		0 0 20½	0
	2 1 21½	* Summation.	2 1 22	
	2 1 23	† Summation	2 1 22½	
		Computation as a whole figure.		
	2 1 24	* Calculation.	2 1 24	
		† Calculation		

* Difference, 2½ Per

† Difference 2 Per.

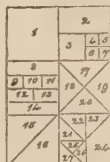
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EXPERIMENT in Computations from Paper (Regular Enclosures).

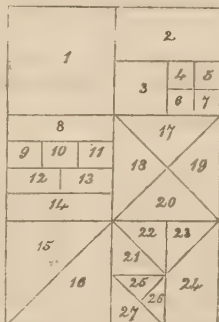
Areas obtained by the Computing Scale from the attached Tracings.

Numbers of Divisions.	12-Inch Computations.		24-inch. Computations.	Difference.
	A. R. P.		A. R. P.	
1	0 1 24		0 1 24½	— ½
2	0 0 32		0 0 32½	— ½
3	0 0 16		0 0 15¾	+ ½
4	0 0 4		0 0 4	
5	0 0 4		0 0 4	
6	0 0 4		0 0 4½	— ½
7	0 0 4		0 0 4	
8	0 0 16½		0 0 16½	+ ½
9	0 0 5½		0 0 5½	+ ½
10	0 0 5½		0 0 5½	— ½
11	0 0 5½		0 0 5½	+ ½
12	0 0 8		0 0 8½	— ½
13	0 0 7½		0 0 7¾	— ½
14	0 0 16		0 0 15½	+ ½
15	0 0 31½		0 0 32½	— ½
16	0 0 32		0 0 32	
17	0 0 16½		0 0 16	+ ½
18	0 0 15½		0 0 16½	— ½
19	0 0 16		0 0 16	
20	0 0 16		0 0 16½	— ½
21	0 0 8½		0 0 7¾	+ ½
22	0 0 8		0 0 7¾	+ ½
23	0 0 8		0 0 7¾	+ ½
24	0 0 23½		0 0 24	— ½
25	0 0 4		0 0 4	
26	0 0 4		0 0 3¾	+ ½
27	0 0 8		0 0 8½	— ½
	2 1 23½		2 1 24½	

12-Inch.



24-Inch.



6 Chains.

4 Chains.

The argument has been adduced that local surveyors generally use the three-chain scale: to a considerable extent this may be so in England, but it has arisen, no doubt, as Lieut.-Colonel Tucker and Captain Driscoll Gosset in the subjoined Reports argue, from the inferior construction of the private surveys having been attempted to be compensated for by the use of an otherwise unnecessarily large scale, and from other lesser conditions which do not affect the national survey.

Irrrelative of the scale of three chains to an inch being a needlessly cumbersome scale for the National Map of England, it seems that it is by no means the usual scale for private surveys in *Scotland*. Captain Driscoll Gosset, whose residence, while employed in the Ordnance Survey operations, of a good many years in various parts of that country, entitles his opinions to be received as the results of a practical experience, which those who are not acquainted with it cannot possess, states that in the south-west of Scotland that scale is by no means the general scale; that no general scale exists, but that the average scale is probably about fifteen inches to a mile; and this is confirmed by some plans of properties and farms in Edinburghshire and Haddington lent to me by Mr. Charteris himself. Out of these plans (eleven in number) only one is as large as the three-chain scale, and the scales of the majority range from thirteen down to six inches to a mile; and Mr. Keith Johnston has given evidence (Q. 491 of the Survey Committee of 1851,) which Lieut.-Colonel Dawson has apparently overlooked, that "estates are generally done upon the scale of two to four inches to the mile in Scotland."

6. That whatsoever may be the weight to be attached to Lieut.-Colonel Dawson's opinion as to the scale required for England, it is open to objection as regards Scotland, a country with which Colonel Dawson cannot be acquainted, from his statements in page 33, that he does not know why any scale required

for England should not be extended to Scotland. One notable difference between the countries is, that Scotland has no wapentake, township, and division and sub-division of township boundaries; its map, therefore, would not be intersected with the net-work that so complicates the English plans; and I presume that no person acquainted with the two countries can for a moment compare either the size of the properties, or of the enclosures, without at once perceiving that Scotland is neither cut up in one way nor in the other as is England; and I scarcely think that the people of Scotland would desire the scale of their map to be determined on the dicta of a person who does not know the nature of their country.

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7. The time and cost of producing a twenty-four-inch map will be so enormous compared with that required for a twelve-inch, that it appears to me that so large a scale as the twenty-four should not be adopted, unless it can be clearly demonstrated that very great advantages would accrue thereby.

The estimates which have been entered into by Mr. Vignoles, as to the probable cost of the twelve and twenty-four inch scales, each engraved and published, are under the mark; and I should place Her Majesty's Government in a false position were I to let these estimates pass without comment. Up to the present time the Ordnance has not had sufficient experience in the twenty-four-inch scale to frame a very accurate idea of the probable cost of a general survey on this scale. But taking into consideration the numerous operations affected by such an enormous increase of scale; that the survey is to be confined to the most close parts, the arable districts, by which no set-off of open work can lessen the average; that wages are daily rising; that the trigonometrical observations and computations must be more intricate and tedious (the sides of the triangles in all surveys being necessarily lessened as the scale is enlarged), and the laying down such triangulation on the sheets must be rendered more troublesome; that the cost of engraving and copper will be greater; that for every four edges of the six-inch plans now to be compared and assimilated (an operation in a general survey taking considerable time and care), no less than sixty-four edges must be made to agree; that the field surveying must be more elaborate, and that the plotting and drawing must be a very much slower process; that the titles, headings, diagrams, references to field books, and in fact every single operation must be increased in a much greater ratio than persons not accustomed to deal with a national survey, as a mass, are aware, I should not be justified in naming as the cost of completing the twenty-four-inch survey as proposed, at less than 2s. per acre: the six-inch survey, as has been stated in evidence, costs about 1s. I estimate that the twelve-inch survey, completed and engraved on that scale, would cost about 1s. 4d.

These estimates are larger than those arrived at by Mr. Vignoles, but he bases his on the cost of tithe maps.

I have inquired into the real quality of these maps, and refer you to the Report of Lieut.-Colonel Tucker, an officer of great experience and sound judgment, who has had occasion in his troublesome duty—the minute investigation of all the public boundaries in the North of England—to consult the tithe maps, and almost every other class of property plans, very extensively. Lieut.-Colonel Tucker gives an almost ludicrous example of the value of a tithe map sealed by the Commissioners, and remarks, without hesitation, that the second-class maps “should be rejected in toto;” “that a few may be tolerable;” that “of first-class plans they are no doubt better than the second;” but that “there would be more trouble and loss of time in endeavouring to adjust them than by rejecting them in toto;” “that the same remark applies to estate plans, inclosure-award plans, in fact, all the isolated unconnected plans with which the deed-chests of our lawyers abound;” and Lieut.-Colonel Tucker concludes by recommending the twelve-inch scale for rural districts; villages and towns to be on exceptional scales. Lieut.-Colonel Tucker has had twenty-nine years of varied experience on the duties of the Ordnance Survey in England, Ireland, and Scotland, and his opinion deserves at least equal consideration to that of Lieut.-Colonel Dawson.

In addition, I append the Report of Captain Driscoll Gosset, whom I lately charged with a special examination of the tithe plans; by this it will be seen that even the best of them are, generally speaking, very indifferent. Captain Driscoll Gosset, after various careful tests, reports them—even the first-class

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tithe maps—to be “*utterly worthless for incorporation into the national survey of the Kingdom.*” Any estimate founded on the cost of producing an indifferent article cannot be received as a guide in the production and engraving of a perfect work; therefore any estimate founded on the cost of producing tithe maps is unsound.

8. Lieut.-Colonel Dawson testifies to the superior execution of the Ordnance maps, and, it appears, has admitted that he would receive them on a scale some inches less than he would receive them from the ordinary surveyors.

The rigid mathematical exactness given by the system of triangulation, and the various checks adopted on the survey to ensure accuracy, should be turned to the most profitable account. Nobody can argue that it is desirable to use a larger and more expensive map than is absolutely necessary; and it appears to me that in no more practical way could the result of the measures, which have sometimes been assailed as over-particularity and unnecessary care on the part of the Ordnance Survey, be better and more economically developed than by the production of a work of seemly compass, possessing all the attributes of a property map claimed by the advocates of a more costly, more cumbersome, and less sightly work, and retaining the utility and value of a general engineering and statistical map with which the size of the twenty-four-inch scale would be totally incompatible.

By the accompanying Index Maps it will be seen that the Map of Edinburghshire, on the scale of six inches to a mile, comprises twenty-five sheets (each three feet by two feet); on the twelve-inch scale the number of the sheets would be eighty-six; and on that of twenty-four inches to a mile no less than 295 sheets would be necessary.

ON CONTOURING AND HILL-SKETCHING.

Mr. Charteris concludes his memorandum (page 24) by a summary recommendation to put an immediate stop to contouring, on the ground that the Committee of 1851 entered fully into the subject.

But I believe that I shall be able to show that on this particular point (contouring) the Committee of 1851 decided on evidence that was faulty, and rejected that which was undeniable; moreover, that had I been permitted to bring forward other evidence, I could have clearly demonstrated that the opinions of those persons who deemed contours useless were erroneous and untenable. Had the Committee acceded to the request made by my executive officer, both in writing and verbally, to the Chairman, to examine other engineers, Professor Gordon, the Professor of Civil Engineering in the University of Glasgow, who kindly came to the committee-room with the intention of giving his evidence, would have probably expressed himself in the same terms he used when he heard certain quotations from evidence given on the subject of contouring, viz., that he would stake his professional reputation to prove to any twelve impartial and intelligent men the superior value of contouring over any other system of hill-mapping. Professor Gordon brought with him into the committee-room numerous one-inch maps which had on them the actual *bonâ fide* trial lines which had to be surveyed and levelled for certain railways, showing how in some cases two, three, and four lines had to be gone over, at great loss of time and money, where, had a six-inch contoured map existed, the best line for adoption would have been at once apparent.

Mr. Macquorn Rankine, the well-known civil engineer, and a distinguished Fellow of the R. S. E., was also present in the committee-room, and willing to be examined. The evidence which he would have given may be gleaned from the following sentence in his letter on the subject:—

“I shall now state an instance in which the absence of contour lines in the one-inch map of England was a cause of delay and expense.

“Being called upon last spring to report on the best means of improving the water-supply of a large town in the South of England, I had to decide, amongst other questions, whether it was practicable to convey to the town the water of certain springs which rise on the opposite side of a range of hills, and what were the proper situations and levels for town reservoirs.

“Several days’ levelling were required to enable me to decide those questions, which, with the aid of contour lines, might have been settled in a few minutes.”

on the

18

References

<i>Surveyed</i>			<i>During the Month.</i>
<i>Detail Plotted on Plan</i>			
<i>Examined on the Ground</i>			
<i>Fair Plans Drawn</i>			
<i>Finally Examined on the Ground by the Officer</i>			
<i>Forwarded to the O.M.O. Southampton</i>			

and to

References

Cut in on the Copper of which Dry Proofs are given

Spirit Levelled

Contoured

Contours Drawn on Impressions

Examined on the Ground

Hills, Sketched

(Forwarded to the O.M.O.)



Mickery Island



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which, with the aid of contour lines, might have been settled in a few minutes."

Published on a Scale of
SIX INCHES TO A MILE

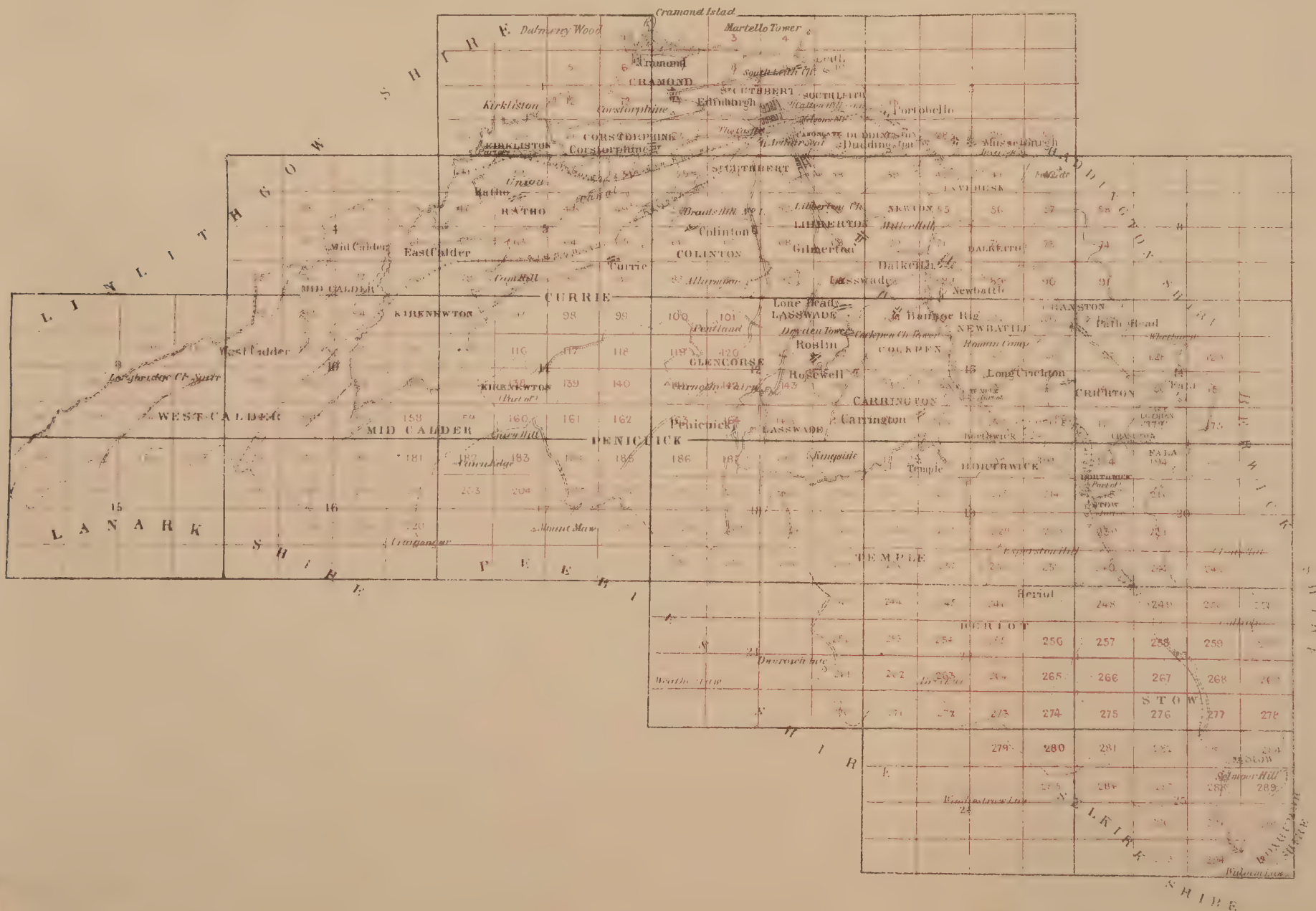
18

Scale 4 Miles to one Inch.

Surveyed
Detail Plotted on Plan
Examined on the Ground
Fair Plans Drawn
Finally Examined on the Ground by the Officer
Forwarded to the O.M.O. Southampton
ap 10

During the Month

*Cut in on the Copper of which Dry Proofs are given
Spirit Levelled
Contoured
Contours Drawn on Impressions
Examined on the Ground
Hills Sketched
Forwarded to the O. M. O.*



Thus writes Mr. Robert Mallet, C.E., M.R.I.A. :—

“ I am myself both a civil and mechanical engineer. I have for about fifteen years had a large practical acquaintance with the extreme value of the Irish Ordnance maps on the six-inch scale. I have paid large sums for contouring some of these, and have used those of Londonderry on the six-inch scale, and of Dublin on the sixty-inch scale, both contoured for sanitary purposes. In fact, with the contours marked in at every 25 feet, or closer, if possible, the whole face of the country would become as obvious as if modelled.

“ But I may venture (though at the risk of egotism) to say that I have some pretension to a knowledge of the value of six-inch contoured maps as a promoter of abstract science; and I do not believe that there is a geologist, a miner, a coal-viewer, or a pursuer of any one branch of natural science, to which a knowledge of the face of the country is important, who will not with one voice commend a contoured map to a large scale; and such a map, uniform in scale for all the British isles, I trust we shall yet have.”

Mr. Alan Stevenson, C.E., F.R.S.L. & E., the eminent Engineer to the Board of Northern Lights, thus alludes to contoured maps :—

“ It is much to be desired that we had for Scotland maps equal to those of Ireland; the combination of lines of equal altitudes, with the large scale, makes those maps most useful to the engineer. Any one who has endeavoured to represent a line of communication through a country on a scale much less than six inches to a mile must have felt how unsatisfactory such an attempt always proves, more especially in a mountainous, wooded, or highly cultivated country, where numerous objects must be shown.”

And Mr. Ranger says :—

“ London : 2A, Pall Mall, June 23, 1853.

“ As regards contouring, I am of opinion that the plans, whether made on the six-inch or two-foot scale, should contain a system of contours, as this will cause a considerable saving of money wherever lines of works are required to be laid down.”

The repeated applications from engineers and others to this office for contours, to be specially furnished to them, afford as many negatives to Mr. Charteris' opinion of the inutility of contours.

The Committee of 1851, by their report, seem to have formed a decision chiefly on the evidence of Messrs. Stephenson and Locke. I shall now proceed to analyze this evidence :—Any person who has perused the whole of the correspondence, from which I have quoted largely in this letter, can then judge whether contours are “ practically useless,” and whether the Committee of 1851 were in any degree more happy in their verdict against contours than they were in their opinion that a one-inch map was all that Scotland required.

The Committee reported that the evidence in favour of contouring rested “ more on theory than on practice, as even Sir J. MacNeill and Mr. Griffith, who spoke most strongly in favour of contouring, admitted that they had had no practical experience of its working, and, on the other hand, Mr. Stephenson is strongly opposed thereto, having had the experience of a contoured map of Switzerland, from which he stated to your Committee that he had derived no assistance whatever in laying out a line of railway in that country.”

Sir John MacNeill (Q. 1203) told the Committee that it was his “ common practice” to run contour lines on those Ordnance six-inch sheets on which they were not shown; and that, in fact, for his purposes, he found it necessary to supply the deficiency of contour lines. This is not mere theory, but practical experience; and in the use of contours, though not of Ordnance contours, Mr. Stephenson (Q. 1827) speaks of the small value of certain six-inch maps in the north of Ireland, when investigating a railway scheme; and (Q. 1831) tells the Committee that the map had some contour lines upon it. Any decision based upon this evidence is manifestly worthless, as there was not a single contour upon the sheets to which Mr. Stephenson refers.

(Questions 1833 and 1836.) Mr. Stephenson refers to the Canton of Zurich and Baden Baden, and informs the Committee that he there found elaborate and exceedingly well contoured maps; and, after being obliged to admit that foreign engineers used the contours in railway works, and had made sections in their study for his guidance, which could not otherwise have been made without sending to the ground to run levels, informs the Committee that

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"on studying from the maps, and on examining those sections, they gave me no real and faithful view of the task I was about to undertake; I therefore began to travel over the whole country,—the difficult parts on foot, riding in some other parts, and where there was no great difficulty I went in a carriage; but it was only by exploring the country, not with their map, but with another map, which was shaded, a more general map, on a small scale, that I laid out the lines; it was a map of Kùgler's, of Switzerland, which was a good map, giving the eminences and the undulations of the country with tolerable faithfulness. Now with that map I went over and corrected their lines which they had laid down, although their engineers were very confident as to the levels they had laid down. Even assuming the two points they were aiming at to be correct, they were modified by me upon the ground most materially; and even where the contour lines were very marked indeed, they had misrepresented the country in some places. I do not mean intentionally, but the contours had not enabled them, in consequence of the great distance between the points, to go so nearly into the section as an engineer is called upon to do."

And (Q. 1849), "I had the map in my hand when I went over the country, and I paid no more attention to the contour lines than if they had not been there, because it is not a matter of a few feet here or there which will guide an engineer."

This evidence on the value of contoured maps of Baden should be contrasted with Mr. Vignoles' official statement.

"In laying out the railways through the kingdom of Wurtemberg, I was enabled, by the aid of similar surveys on a large scale, to accomplish a vast deal of work in a short time, and at a very small expense. In that country the levels were not everywhere completed; but when I came to the difficult junctions of the Wurtemberg railways with those of Baden on the west, and of Bavaria on the east, the system of contouring levels adopted in these countries, especially in Baden, enabled me to solve with the utmost facility and despatch questions of importance at issue between the respective Governments, in a manner I could not otherwise have done in the satisfactory way I have reason to know was the case."

Such undeniable testimony to the immense value of contours, placed fairly side by side with Mr. Stephenson's assertions, would certainly lead any unprejudiced person to the conclusion that Mr. Stephenson failed to make the most of a contoured map, and not that the contours failed to give information; and Mr. Vignoles' positive demonstration of the practical value and actual use of contours in the difficult question he quotes, must in the same way render Mr. Locke's IDEAS of the inutility of contours, as expressed by his contempt for them had he had them in the Beattock Pass (Q. 2025), open to a similar inference. Mr. Vignoles would have made a different use of contours then.

How contours can be termed "practically useless," or how any person can dispute their being, on the contrary, of the utmost value, after the evidence I have quoted, I cannot conceive, unless the combined testimony of Sir J. MacNeill and Mr. Vignoles is to be set aside, without rhyme or reason, in favour of Mr. Stephenson's and Mr. Locke's. Neither one or the other of these gentlemen, be it marked, appear to have used a six-inch contoured map.

(Q. 1241.) Speaking of a number of altitudes or contour lines upon the map, Sir John MacNeill states that the contours give the *shape* of a hill, which altitudes do not.

Again (Q. 1889): "Do you believe, if the South of England was contoured, the water-shed lines being employed, that would assist the labours of the Committee which is sitting on the water-supply of the metropolis at the present moment?" to which Mr. Stephenson replied, "*Not one atom.*"

I unhesitatingly challenge the decision arrived at on such evidence as this. I confidently affirm, as an engineer, that such a contoured plan would be of greater value for the purpose than any plan that could possibly be made. Thus writes Mr. Rankine of a somewhat parallel case:—

"Being called upon last spring to report on the best means of improving the water supply of a large town in the South of England, I had to decide, amongst other questions, whether it was practicable to convey to the town the water of certain springs which rise on the opposite side of a range of hills, and what were the proper situations and levels for town reservoirs. Several days' levelling were required to enable me to decide those questions, which, with the aid of contour lines, might have been settled in a few minutes."

And Mr. Vignoles: "In conclusion, permit me to advert to the great question of the day, that of supplying London with an abundant flow of water. Can anything be considered more truly national? I appeal to every unprejudiced engineer, could anything be more generally useful at this moment than a system of contour levels for 30 or 40 miles round London, in order that not only professional men, but that other men of science, members of both Houses of Parliament, and educated people in general, should be, in some degree, put in a position to judge of, and to weigh and compare the facts, with the opinions laid before them,—facts which by these documents would be put in the broadest light, and divested of all technical mystery? Would not such a system of contouring have been of vast value in discussing the great drainage question? Even now I consider that these matters alone would fully justify a system of circa-metropolitan contouring, and, if good for the present purposes of the drainage and water supplies for London, why not for the purposes of any town, nay, of every village in the United Kingdom?"

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Which is to be considered the more competent person to give an opinion on contours, the person who has used them with such great advantage as Mr. Vignoles, or Mr. Stephenson, who could not manage them under similar circumstances?

Would any one take the opinion of a person having a mere smattering of Latin on a work in that tongue, in preference to the opinion of a person master of the language?

Mr. Keith Johnston's evidence is (Q. 548): "You are doubtless acquainted with the system of contouring?"—"Yes."

(Q. 549.) "What is your opinion of its value for purposes of general utility?"—"I think it is a process of the utmost value for surveys on a very large scale." The Committee have used his evidence very largely on many points, and Lieut.-Colonel Dawson recurs to portions, but it would seem that this very strong evidence in favour of contours is totally overlooked.

But I have further to draw attention to many admissions in the evidence of 1851 by persons who were evidently unfavourably inclined towards contours, admissions which bring me to that part of the correspondence relative to the question of delineating the features on the one-inch map, whether from reduced contours, from sketches on the ground, or from a combination of the two means. Lieut.-Colonel Dawson commences his notice of the hill-delineation by these words: "The standard of excellence aimed at by the Ordnance Survey of Scotland Committee was the Ordnance map of Wales." Now it is to *surpass* this "standard of excellence," which it is my intention to aim, for it is certain that a better map than the one-inch of Wales can be produced, and I consider with Mr. Keith Johnston, that the map of Scotland, both large and small scale, "should be made a model map, something such as *has never been done before*." And, "I should desire above all things to see proper means taken to have it done in the best manner." And what are the means of which Mr. K. Johnston approves? A combination of contour lines with hill-shading—as the following quotations from his evidence show:—

(Q. 563.) "The plan of proceedings (in France) is to make the drawing with contours, and to make that the basis of hill-shading for the map of France, but the contour lines are not engraved on the plates."

(Q. 564.) "Is there not much greater accuracy?"—Yes."

Lieut.-Colonel Dawson quotes Mr. Johnston's evidence (Q. 568), but does not quote the sequel to it (Q. 569), viz. :—

"Do you think that the two can be combined, the contouring and hill-shading?"—"Yes; and the object of this sketch (referring to a combined drawing) was to show that they could be combined."

(Q. 657.) Mr. K. Johnston alludes to the uncertainty of hill-shading unaided by contours. And (Q. 659) informs the Committee that he does not consider oblique shading would be sufficiently correct for ordinary purposes, such as a railroad or a road.

Sir R. I. Murchison (Q. 81) admits that contours are applicable to soft, undulating countries, and (Q. 89) says, "If contours are correctly given all over the country, doubtless (the map) would be more accurate. The gentlemen of the survey know that much better than myself."

And Mr. Hall Maxwell, in reply to Q. 349, "What is the opinion of the directors of the Highland and Agricultural Society as to the value of contouring

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in an agricultural and general point of view?" replies: "Their opinion is that contour lines should be retained, and that they are advantageous in an agricultural point of view." And (Q. 368) states that the map which he is instructed to ask for, is a map shaded and contoured on the one-inch scale.

Mr. Brunel answers to Q. 260, "Which should you consider the most accurate method of delineating—the contour lines or the hill-sketching?" "The contour lines must be much the most accurate." And in Q. 264 further states, that the accuracy of hill-sketching depends more or less upon the accuracy of the eye of the sketcher, and upon his honesty; and, speaking of the Ordnance one-inch map, says, some are "very bad." "I have known places where the hills and the valleys pretty nearly alternate; that is to say, there are hills where there ought to be valleys, and valleys where there ought to be hills; whereas the contour lines, of course when taken, afford *you the means of shading the map perfectly and accurately.*" And in Q. 271 Mr. Brunel continues: "If in addition to the general shading of the country, you can have all these contour lines, they cannot well fail to be useful on many occasions, and *to be a wonderful check to the correctness of the shading.*"

That the one-inch map of Scotland should have all the benefit of the improvements which experience has suggested every body must desire. That it should not portray hills where there are valleys, and vice versâ, as Mr. Brunel complains the English map does, every Scotchman must anxiously hope; and it is to prevent such errors as I hear are complained of, even in the often-quoted Welsh sheets, that I deem the foundation of contours a decided and necessary step towards a more perfect and better map for Scotland.

I do not say that the hill-shaded map must therefore of necessity have the contours engraved upon it, but I affirm that contours (varying in number according to the nature of the district) will compel the hill-sketcher or hill-draftsman to make a more truthful picture of the ground.

I beg to call attention to a very excellent letter from Captain Leach, an officer of fourteen years experience in hill-drawing. Captain Leach says: "In considering this subject it is not to be forgotten that contours form the best possible basis for hill-sketching on a large, or hill-shading on a small scale. It is a curious fact that Colonel Dawson himself appears to have used contours to check or assist his hill-shading," as Captain Leach discovered by consulting old hill-sketches and essays made by different persons employed under Colonel Dawson at the dates found on these documents. These contours, either instrumental or approximate, with their respective altitudes numbered, are marked in red ink, the hill-shading being in black.

With Captain Leach's opinion, so very well expressed, I entirely coincide. Detailed contouring for large-scale maps is indispensable if physical form is to be properly represented, and I assume, as a matter of course, that it is to be represented in some way or other, and the hill-shading of the smaller-scale map should be based on occasional contours to ensure accuracy.

These contours, as Captain Driscoll Gosset suggests, can be cheaply and rapidly added to an electrotyped copy of the hill-shaded plate, and thus will the wishes of the ordinary public, and the requirement of the engineer and man of science, be both met; and those who prefer hill-shading only can purchase the simple hill-shaded sheet, and those who want the contours will be able to obtain them from the duplicate plates.

Reference has been made by Mr. K. Johnston as to the French system and opinions in that country: I therefore communicated with the Director of the *Dépôt de la Guerre*, and requested his opinion on the two points, hill-shading with or without contours. Thus writes the distinguished chief of that Department, and, as the Scientific Superintendent of the great Survey of France, his words are entitled to the highest consideration: he says briefly:—

"Paris, 8th June 1853.

"As to the two delineations, I can conceive that either method (the horizontal contours or the hachures) has its partisans, but what I cannot understand is that any one should deny the utility of the contours. They appear to me to have two important advantages; firstly, they give much more truth to the map drawn in hachures; secondly, they facilitate to the engineers the studies relating to their work. On a map drawn in contours they trace with greater ease the project of a canal or railroad than on a map drawn in hachures, where the level lines cannot be followed, and where it is impossible to determine the relative height of the slopes, in order to choose the fittest for the railroad to pass."

"In the maps on a scale of $\frac{1}{40,000}$, which all our officers make, the hills are figured by hachures, but they are not made until equidistant horizontal contours have been previously traced, which serve to direct them and from which the officers produce a finished drawing."

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And encloses a long report from Mons. Hossard who has the direction of the Topographical Section. From this, which enters into the minute details rather voluminously, the following extracts will show that, so much do the French regard contours, and distrust hill-sketching without their aid, that every hill sketched or hill-shaded drawing sent in to the Head Quarter Office, *must* be accompanied by the contour drawing on which it is based, as a check upon the hill-sketch.

"The sketches of the map of France on the scale of $\frac{1}{40,000}$ m. are drawn with the hachures from contours equidistant ten metres. A contoured drawing on the same scale is joined to the above and preserved with it in the archives.

"The reductions to the 80,000m., destined to serve as a model for the engraving, are drawn after the same principle, and a contoured drawing of the same given to the engraver: on this scale the vertical distance is twenty metres.

"The engineers of 'pont et chaussées' and of mines, who come every day to the Dépôt de la Guerre to consult the manuscript plans at the 40,000 of the map of France for the projecting of roads or of railways, and who are permitted to avail themselves of the same, *all beg* (demandent tous) that the horizontal contours may be copied on these drawings, and that the altitudes may be marked on them, but not the hachures, which they regard as completely useless to them in the studies they have to pursue.

"The most serious objections which have been opposed to the method of contours are,—first, that it does not express the accidents of the ground, nor the change of slope between two contours; secondly, that it produces maps without expression. This first inconvenience may be avoided either by drawing the scarpments and the rocks, as one is besides obliged to do in topography by hachures, or by having recourse to interpellated contours.

"The second fault is well rewarded by a greater precision being obtained in the figure, the operation of the mind, by means of which we arrive, so to speak according to M. Arago, to model the hills by the sole inspection of horizontal contours is so natural and so satisfactory, however little habituated one may be to it, one will seize even at the first glance the forms of the relief with more precision perhaps than if it were expressed by shading. Nothing need besides prevent, if we think proper, from uniting the two effects by adding to the contours light tints of colour."

"Engraved Maps."

"As for the maps destined for the public, whose topographical education is extremely limited even among well-educated men, they must be above all easy to conceive, and speak to the eyes. For these maps it is then proper to express the configuration by hachures.

"When the scale allows of it one will give greater precision to these maps by submitting the hachures to horizontal contours as one does in manuscript maps."

Lieut.-Colonel Dawson has carefully extracted all evidence bearing against the system of contours, with the intention of detracting from its merit; but I have shown clearly that, whatever may be the opinions or ideas of a few persons, a large preponderance of opinion is strongly in favour of using contours on the large-scale maps, and as a basis for hill-sketching on the small.

Sir John MacNeill (Q. 1246), though not suggesting that the one-inch map for the public should be furnished with reduced contours, but by hill-shading, yet says: "But I would recommend that the one-inch map should be shaded from the data which are given by the contour lines laid down upon the six-inch map. I do not think it possible for the most accurate man you can get to sketch the country, giving you anything like the same degree of certainty that a map shaded from the contour lines will give you." And in Q. 1247: "The contours would be the greatest possible guide. A man would go over three or four times as much ground in a day, I think, and do the shading with those contours, as he would without them, and *much better*."

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As an engineer I should, as I stated before the Committee in 1851, consider that the reduced contours would render my map more valuable than hill-sketching by hachures. Mr. Vignoles is of the same opinion. With the contours any one may shade his map in whatever system of light and shade he pleases, but from hill-shading an engineer cannot trace the contours.

But though I state my opinion of reduced contours, yet, as the general public prefer hill-shading, it may be desirable to gratify their wish, and it would be my duty to produce the very best hill-shaded map possible. And this can best be done, despite assertions to the contrary, by using the reduced contours of the larger-scale maps in the lower country, and occasional contours in the higher regions as a basis for the hill-sketchers. Errors similar to those complained of even in the much-lauded Welsh maps should not occur in Scotland.

I have quoted sufficient to show that contours do act as a test and aid to hill-sketching, and for this reason have been used even in the essays for models.

As it is not proposed to contour the barren and mountainous districts (amounting, it is said, to two-thirds of the whole of Scotland) to anything like the degree of nicety required for the arable portions, but merely to run contour lines sufficient to serve as a basis for a correct delineation of the hills, the estimate for contouring the whole of Scotland, as given by Mr. Charteris, will, it is clear, be very considerably more than is necessary.

Lieut.-Colonel Dawson, in page 38, in speaking of his own experience, seems to forget that while he has been absent from his corps duties for the unusually long period of 17 years, his brother officers have been studying their profession, and, amongst other legitimate subjects of it, the various systems of hill-delineation on all scales in vogue, and that the Ordnance Survey, since Lieut.-Colonel Dawson's connexion with it, has acquired an *accumulated amount* of experience and information that should render its opinions on these subjects worthy of respect and confidence. And, with reference to the comparison between the labours of a portrait-painter and that of a hill-draughtsman, should remember that hills are not animated objects; and that, as to mechanical applications to express forms being subject to his satire, the medallion engraving, which is done by machinery, is universally admitted to express relief almost to perfection.

In page 40 of the late correspondence, the evidence of 1851, touching the difficulty of procuring hill-sketchers, is recurred to, and Lieut.-Colonel Dawson is induced to remark that "none but those especially educated by Mr. Dawson" (N.B. his father), "or by those whom he taught, can be qualified to practise hill-sketching and drawing as he practised it in Wales, because the style originated with him, and was peculiarly and exclusively his own, and it is not to be acquired by any mechanical process, nor can it be taught in a day. By way of exemplification, I may point to the recently published sheets of the neighbourhood of Sheffield, and a portion of Derbyshire, with which Mr. Dawson had nothing whatever to do; and with reference to the objections taken to those sheets in the answers to Questions 1534, 1536, I would beg to observe, that the pictorial effect or expression of a map is not simply dependent on the use of vertical or horizontal hachures, as a means of producing it, for, in fact, it may be produced equally with either; it is in reality due to the just and proper application of the principles of light and shade. For the field sketches, horizontal hachures or lines are used, and they would probably have been introduced into the engraving process also, but that the public generally are not accustomed to them, and would not probably understand them. Nor is the difficulty complained of 'in deciphering the names along the sides of the valleys' a necessary consequence of using vertical hachures, but of working with machines, instead of 'people who can think and act, and exercise discretion,' otherwise the result should have been the same in the map of the mountainous districts of Wales. It is, in fact, attributable, and solely attributable, to the want of artistic apprehension and ability on the part of the draughtsman, or to the engraving being made, as it were, by a machine, without the intervention of a draughtsman at all."

This sheet was brought forward to show that hachures were liable to serious objections when the hill features were complicated and strong in the vicinity of populated places; but so far from its having failed for the reasons assigned by Lieut.-Colonel Dawson, the hill-drawing was made by one of the old trained draughtsmen, a pupil of Mr. Dawson's.

The fact is, and it is futile to deny it, that the effect of any system of shading

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interrupted by the quantity of detail and names as on the Sheffield sheet, must be in a very great degree spoiled, and the engraving by hachures, and the biting of the work on the copper, become an operation liable to produce, under such circumstances, an unsatisfactory appearance. When the detail is close, and the country hilly, either the names or the hill-shading must be left out. This is one of the imperfections of the system of shading, which, notwithstanding Lieut.-Colonel Dawson's positive assertions, I emphatically reiterate.

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In connexion with the repeated reference to the Welsh maps, it may not be known to Colonel Dawson that the system of light and shade attempted to be carried out, however feasible in colours, was found impracticable in engraving, without rendering the details of the map in some places too obscure, and the light and shade had to be modified for the engraving, and the effect was deemed to be much more favourable, and, as to its pictorial expression, is by all admitted to have given satisfaction to the public.

In the concluding paragraphs, suggestions are put forward for the guidance of the Superintendent of the Survey in many petty details: it is sufficient for me to state, that I shall be quite prepared to carry out any system which may be decided upon, and Lieut.-Colonel Dawson is, I presume, unaware that, since the Committee of 1851, an officer of Engineers, an experienced and first-rate draughtsman, and well adapted for the duty, has been specially selected and appointed for organizing a competent force, and carrying out the hill-delineation of Scotland.

The following is an abstract of the evidence as given before the Committee on the Ordnance Survey (Scotland) 1851, and the persons referred to in this Report.

For Contours on large maps.	For Contours on small maps, either by themselves, or as a base for or combined with hill-shading.	Against Contours.
Mr. K. Johnston. Sir John Burgoyne. Lieutenant-Colonel Hall, R.E. Mr. Vignoles, C.E. Captain Leach, R.E. Captain Yolland, R.E. Mr. Griffith. Mr. R. Vans Agnew. Mr. Ranger Captain Driscoll Gosset, R.E. Lieutenant-Colonel Tucker, R.E. Mr. Macquorn Rankine, C. E. Professor Gordon, Professor of Civil Engineering, University of Glasgow. Mr. Mallet, C.E.	Mr. K. Johnston. Sir John Burgoyne. Lieutenant-Colonel Hall, R.E. Mr. Vignoles, C.E. Captain Leach, R.E. Captain Yolland, R.E. Mr. Griffith. Mr. Hall Maxwell. Captain Driscoll Gosset, R.E. The French National Survey. Humboldt. Berghaus.	Mr. Charteris. Lieut.-Colonel Dawson, R.E. Mr. Stephenson. Mr. Locke.

In conclusion, for the manuscript and engraved plans of Scotland, if private-property purposes are to be satisfied, I would recommend the twelve-inch scale, provided that scale is considered satisfactory for obtaining areas (villages and towns on larger scales). But if the twelve-inch scale be not deemed fully equal to give areas, I should certainly prefer the six-inch scale for publication, as being decidedly of more *general* service to the community. The twelve-inch scale loses *some* of the value as a general map that a six-inch possesses. If property purposes be fully satisfied by a twelve-inch scale, this advantage to proprietors may be considered as a sufficient recompense for that loss; but, if recourse must still be had to a twenty-four-inch scale—that is, if the twelve-inch does not *fully* satisfy all private-property purposes, then its but *partial* advantage for those purposes over the six-inch would, in my opinion, be too slight to compensate for the other loss of its utility as a general public and engineering map.

In defining the “arable districts,” supposing the twelve-inch to be the scale fixed on for publication, it will be necessary to give the Superintendent of the Ordnance Survey discretionary power. The accompanying index of Edinburghshire shows how the cultivated and uncultivated (though sometimes enclosed) districts are intermingled. The southern counties of Scotland will all be found to resemble Edinburghshire in this feature, more or less.

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In such cases it would manifestly be narrow policy to confine the twelve-inch scale to any portion of the county; it would be preferable to sweep over a whole county on one scale, and thus render the work more creditable and more complete.

Whatever may be the diversity of opinion as regards the proper scales for the National Surveys of England and Scotland, I cannot understand that doubts should exist as to the superiority of contouring over any other system for physical relief on the large scale, and as a basis for any kind of expression of relief on the one inch map.

In thus firmly expressing my estimation of the great value of the system of contouring, I echo the opinion of Humboldt, and give the result of General Colby's long experience, and of the accumulated experience of this department.

The following specimens accompany this Report.

Sheet 1 of Edinburghshire, 6-inch.	{	Selected as the first sheet published.
$\frac{1}{4}$ of same enlarged to 12-inch.		A highly-cultivated country, with gentlemen's seats.
$\frac{1}{16}$ of same enlarged to 24-inch		
Sheet 11 of Edinburghshire, 6-inch.	{	Selected as the first <i>full</i> sheet published, and showing the intermixture of arable with uncultivated land. The study of these three specimens will convey a very good idea of the size of the three scales.
Ditto, enlarged to 12-inch.		
Ditto, enlarged to 24-inch.		
Sheet 216 of Yorkshire, 6-inch.	{	Selected to show what the 12-inch scale is in the very <i>closest</i> English work.
$\frac{1}{4}$ of ditto, enlarged to 12-inch.		
An experiment in areas, 24-inch, and reduced to 12-inch scale.		
One-inch England sheet, contoured,—Hill-shaded, and engraved from contoured plans.		
Ditto, with contour lines upon shading.	{	To show how the duplicate plate might bear the contours over the hill-shading.
Ditto, contours coloured.		To show how an engineer uses contours in his study.
Hill-drawing (sepia), done without visiting the ground.	{	To show those who speak against contours, that contours do not injure the "spirit" of a shaded drawing.

LIEUT.-COLONEL TUCKER, R.E., to LIEUT.-COLONEL HALL.

Newcastle-on-Tyne, May 14, 1853.

In obedience to the order of the 10th instant "to peruse the accompanying "Treasury correspondence, and give my opinion on the subject thereof, and "especially on the value (for incorporation into a general map) of the various "classes of plans I have encountered and tested in so great a variety," I have the honour to submit the following:—

It seems to me that the opinion expressed in the following lines of the 4th paragraph of Mr. Charteris' Report, page 23, viz., "The scale which it would appear is best adapted for a survey suited to all civil purposes is three chains to an inch, equal to $26\frac{2}{3}$ inches to a mile, therefore, should be adopted for the Ordnance Survey," is open to discussion. On that point, my opinion, which I state most respectfully, is, that for what are termed rural districts the three-chain scale is, except for villages, needlessly large and expensive. The idea that the scale of three chains to an inch is the smallest that can be relied on for computing areas has originated most probably from the mode in which surveys were made in former days, and has grown part of the system. A very minute portion of a grain can now be weighed, the mechanism of the balance having

been improved; formerly that could not be done with the indifferent machines then in use. The six-inch-scale plan, or Ordnance Survey, being based on trigonometrical data, by which the area of each triangle is mathematically obtained, the computation of areas can be made to a great degree of accuracy, because the summation of the areas of fields or inclosures, with parts thereof, can be tested or checked by the mathematical areas, which are totally independent of the surveyors or persons who measure the lines and keep the field notes of the survey, from or by which the plan is made.

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Very few indeed, I believe, of three-chain plans hitherto completed have been constructed on or laid down by trigonometrical distances, obtained from carefully measured bases; therefore the areas obtained by computation from all three-chain plans, excepting the very few alluded to, have not been checked by the mathematically-obtained areas of triangles. A three-chain plan, laid down from measured lines only, may be too large or too small; that is, the measured distances may exceed or fall short of the *really* true distances; therefore all the areas of enclosures may be too large or too small.

This is adduced to show that a three-chain plan will not give correct areas if the proper mode of constructing it has not been adopted, and when they are not constructed by means of calculated distances, the areas cannot be obtained with that nicety which is supposed to be a consequence of the size of the scale.

Mr. Griffith states, in page 28, "I find the six-inch scale sufficient for determining the areas of tenements not less than one acre," which is a positive assertion founded on the valuation of Ireland. The areas computed from the six-inch plan for tenements above the area of one acre can be computed correctly. They can be tested by the mathematical area of each triangle.

The computations from three-chain plans do not always give correct areas, but areas assumed to be correct, because a better system has not been adopted. Is a three-chain plan absolutely necessary for most of the civil purposes mentioned in the Treasury correspondence? Not for the computation of areas of fields or tenements of and above one acre, if those areas can be obtained with as great a degree of accuracy from the six-inch scale as the supposed correct areas computed from three-chain plans; and I trust to be able to show that in my humble opinion, an infinitely-superior system based on trigonometrical arrangements can be adopted.

In page 24, paragraph 4, it is stated, "it thus appears that a map on the scale of twelve inches to a mile, *which would be applicable for all those civil purposes to which reference has been made*, might be completed and published at a cost so trifling in comparison with the public benefit to be derived from the survey as fully to justify such expenditure." The part underlined by me evidently proves that the three-chain plan is required solely for the computing of the areas of fields or tenements; it proves also that the twelve-inch scale affords the clearness of detail necessary for close rural districts (villages excepted), and it will be much less cumbersome, also more generally useful, than a three-chain map.

That the three-chain plans are required solely for the computation of the areas appears in the 4th paragraph, page 23, where it is stated, "the scale of three chains to one inch was recommended by the Tithe Commissioners in a letter, dated 18th February 1837, to the then Chancellor of the Exchequer, Mr. Spring Rice," because they say "that unless the contents of fields can be computed from the map itself, and compared with the Book of Reference sent with it, there is no real security for the correctness of either of those documents."

The Commissioners then state "that they have a clear opinion, strengthened by the concurrence of a very great majority of the practical surveyors they have consulted, that, taking the country throughout, a scale of three chains to an inch is the smallest that can be safely relied on for such computations, and they, therefore, recommend that scale for general adoption.

"This recommendation was, in a great measure, based upon the Report of Lieutenant (now Lieut.-Colonel) Dawson, Engineer to the Tithe Commission." The correspondence states that the *twelve-inch scale will be sufficiently large for all the civil purposes* to which reference is made; that is, the detail will be sufficiently clear and distinct.

Should, therefore, public purposes require the scale of twelve inches to a mile to be adopted, on account of the increased clearness of detail over the

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present six-inch map, the enlarged size of the plan (four times that of the six-inch) will admit of the easy and accurate computation of the areas of tenements or fields of one-eighth of an acre and upwards. The areas will be checked or tested by the areas of the triangles obtained mathematically. Areas so obtained will be much more correct than the areas obtained from three-chain plans, as they have hitherto been constructed.

If the publishing on the twelve-inch scale is to be adopted, the enormous expense of making plans on the three-chain scale, solely for computing areas, will be useless.

For tenements smaller than one-eighth of an acre a larger plan than twelve inches to a mile will be required for computing their areas; but those portions will be exceptions.

Those exceptions are partly provided for already by the plans of towns on the large scale; therefore there remains only the small towns and populous villages not hitherto drawn on the large scale; the expense of preparing plans of which on the scale of twenty-four inches to a mile will be very small in comparison to the plotting whole districts of country on that scale, more especially in Scotland, where even in the most arable counties the villages are so very few and so far from each other.

I am of opinion that areas obtained from twelve-inch plans (from twenty-four-inch plans for villages and small towns; from the large plans of towns for populous places), in the manner detailed, would certainly be more accurate than areas computed from the three-chain plans, as they have hitherto been constructed.

In the third paragraph of page 31, line 19, it is stated also that, "during the time the Ordnance Surveyors were engaged with the preparation of their six-inch maps of Lancashire and Yorkshire, they were called upon and employed to make, at the expense of the landowners, twenty-three plans of parishes and townships, on the scale of $26\frac{2}{3}$ inches to a mile for Tithe Commutation purposes."

It must not be inferred that by preparing the said twenty-three plans the Ordnance Survey expressed an opinion respecting the importance or value of the scale: having made the surveys for the general plans of the counties, and having large means at command, the Ordnance undertook to draw the plans on *being requested* to prepare them. So also plans of lands to be inclosed near Nottingham were, at the desire of the Inclosure Commissioners, prepared on the preposterously large scale of half a chain or eleven yards to an inch.

With reference to the second part of the order, directing me to state "the value (for incorporation into a general map) of the plans I have tested in so great variety," I have to inform you I am of opinion that the plans termed in the Tithe Commutation Office second-class plans should be rejected in toto. I notice them by name because they are public documents, therefore open to remark, and, in carrying on the duties of the Boundary Department, have come very extensively under my observation.

They are styled plans, but the Tithe Commissioners regard them little more than indices.

The greater portion of them have been compiled or prepared from plans made at various times; and, as the landholders or occupiers are contented with them, their accuracy is not questioned.

A plan of that class was signed by the Tithe Commissioners, anno 184—. A boundary, together with some of the adjoining fences, had been obliterated and destroyed about twenty years ago. As the tithe plan could not be depended on for showing the boundary correctly, other plans were inquired for, and an estate map was procured for which the survey was made at the end of the last, or at the beginning of the present century. On comparing the trace from the tithe plan, dated 184—, it was found to agree with the old estate plan, though the survey for the latter was made *before* the boundary and adjoining fences had been removed; and the former purported to have been made *after* the fences had been taken down. That shows no dependence can be placed on that class of plans, with which must be included a large proportion of those used for township and parochial purposes, as they are compilations or copies. A few may be tolerable, or prepared from recent survey made for the purpose, the expense of testing which to ascertain their bonâ fide value would, however, amount almost to the cost of a survey.

Portions of detail might be found individually but not relatively good; and

it would not be possible to incorporate them with the surveys of surrounding places laid down from trigonometrical data, because the survey from which such portions of detail of a plan were drawn, not having been checked by trigonometrical distances, the general outline of the plan is twisted or unduly enlarged in one direction or another.

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The plans termed First-class Tithe Plans are, no doubt, better than the second-class plans, but they are comparatively few in number; and, as they also are not constructed on trigonometrical data, I think there would be more trouble and loss of time occasioned by endeavouring to adjust them to surrounding plans laid down with trigonometrical distances than would be occasioned by rejecting them in toto. They, like the second-class plans, may be too long or too short in one direction or another.

The observation applies to estate plans, inclosure-award plans,—in fact, to all plans not constructed with trigonometrical data.

I have to recommend that the draft plans of rural districts to be preserved as public records be on the scale of twelve inches to one mile, and the same scale for the engraved plans; that villages and small towns be drawn on the scale of twenty-four inches to one mile; that the plans of large towns be regulated according to the condition and circumstances of each place, and engraved on the scale on which each town is drawn, the scales to be ten feet and five feet. As an instance, the portions of Newcastle-on-Tyne, along the river-side, and on the acclivity of the hill, where the streets, lanes, and alleys are either tortuous or very narrow, and the houses are generally of a narrow frontage, will require to be drawn on a larger scale than the New Town of Edinburgh, of which the streets are regular, wide, and the houses have a good frontage.

The contour lines afford useful information and data for so many practical and scientific purposes, that I think they should be retained, the vertical distances between, or altitudes shown by, them to be varied according to the nature of the ground.

CAPTAIN LEACH, R.E. to LIEUT.-COLONEL HALL.

Derry, June 1, 1853.

Four Irish counties have been contoured. The system of contouring has been brought to great perfection, accuracy, and cheapness. Professional men and the public are beginning to appreciate its value, and I am convinced that its abandonment now would create great dissatisfaction in this country, and if it is retained here and given up in England and Scotland, those who have been instrumental in throwing it overboard will one day have cause to regret the step they have taken, when its value and importance becomes more thoroughly understood, and the public have learned to comprehend and read it, which they will very soon do when the whole of the four counties mentioned have been published.

I have just read a correspondence circulated by Government among Members of Parliament and others in reference to the several scales proposed for the English and Scotch maps, into which the subject of hill-sketching versus contouring is also introduced by Lieut.-Colonel Dawson, and which, with the evidence taken before the Scotch Survey Committee, I presume forms the ground upon which Government now proposes to abolish contouring. Your own views on this subject are strongly expressed in the latter, but it does not appear to have been circulated, and in the absence of any opinion either from yourself, Sir J. Burgoyne, or Major Tarcom, to whom General Colby attributed the merit of introducing contouring, the correspondence cannot be considered a fair expression of competent opinion upon contouring, or the point to which it refers.

It appears to me that the character, uses, and values of contoured and shaded maps, which are perfectly distinct, have been confounded together, and that in consequence both have been misunderstood by the greater number of those who have given evidence on the subject. The value of contours is the mechanically accurate and precise general representation of ground and its altitude they convey to those who understand and have learnt to read them, and are chiefly applicable to maps on a large scale.

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Hill sketching or shading is applicable for small-scale general maps, and is intended to exhibit at a glance a pictorial representation of ground, without any definite idea of altitude further than varieties of shading, assisted by a few figures, can give: each is useful for its distinct and separate purposes; neither will subserve both.

Being the son of Mr. Dawson, Colonel Dawson's prejudice in favour of hill-sketching is not surprising; but I am surprised that an officer of his experience should not apparently have realized the distinct and separate values and uses of contouring and hill-sketching, and that he should have advocated the one at the expense of the other. I can scarcely believe that he intended to do so, but in his desire to impress the merits of hill-sketching for a one-inch map, he has in his letter entirely overlooked the value and importance of contouring for the larger-scale maps, and has quoted evidence given in reference to a one-inch map, and which, as you must be well aware, evinces a most complete ignorance, on the part of those who gave it, of a perfect system of contouring on a large scale, and the mode in which it is carried out; vide evidence, for example, of Messrs. Brunel and Locke, pages 39 and 40 of correspondence. I am astonished that this should have escaped Colonel Dawson's observation.

If contouring is to be given up, the question naturally arises, how is the physical form of the ground to be represented on large-scale maps? I assume, as a matter of course, that it is to be represented in some way or other.

To abandon contouring, and to return to single figures or hill-sketching alone, would be to retrograde from accuracy to inaccuracy, from a perfect representation of the ground available for all engineering and other purposes, in which the physical features of the country are required to be accurately known, to a mere picture, useful undoubtedly for a small-scale general map, but otherwise of no practical value; and the expense of which, in proportion to its value, would be very large as compared with contouring, which, it should be remembered, when once done requires no revision, and will last for generations.

Mr. Keith Johnston begs for a *model* map of Scotland, which it is obvious could only be made with accuracy from contours, certainly not from hill-sketching, which leads me to suppose that his evidence would have been in favour of contours had he been intimately acquainted with their nature and value.

Contouring is the only known mode of representing ground on paper, so that a perfectly accurate general section could be made from the plan of any arbitrary line, no matter in what direction it might be selected or required. A contoured plan conveys all the information of a model, without its inconveniences for practical purposes.

I could mention many instances in which I have known the value of contours practically turned to account, but it would needlessly occupy your time. I will give but one case as an example, which came under my notice the other day, in which an engineer was enabled to determine upon our new Donegal contoured maps the best line for a railway to connect two places about fourteen miles apart, without going to the ground at all in the first instance, or the necessity for surveying or examining any other line of country.

This alone is sufficient to show the accuracy and intelligibility of a contoured map, and its superiority over a shaded map, upon which the same thing certainly could not be done.

It is well known that contours, or zones as they are called, are used by the naval profession to represent on their charts the form of the ground underneath the water, as we represent it above, as a great improvement upon the old system of multitudinous figures.

Imagine the astonishment of a sailor, if you proposed to give him a sketched chart as *better* than one with definite depths marked upon it; and surely no one would venture to say that definite heights are not as necessary for the engineer, as depths for the sailor.

In considering this subject, it is not to be forgotten that contours form the best possible basis for hill-sketching whether by contour-sketching on a large, or hill-shading on a small scale. It is a curious fact that Colonel Dawson himself appears to have used contours to check and assist his hill-shading (see specimens enclosed, which I found among other old documents in this office).

The heights at which contours are to be seen, their vertical distance apart in mountainous countries, the best mode of making shaded plans, whether from reduced contours or by hill-sketching on the ground with the assistance and

guide afforded by the contours, all frequently mentioned in the papers to which I have referred, appear to me to be matters of detail which properly devolve upon and belong to the Superintendent of the Survey.

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But of this I am sure: that the minute character of the ground cannot be represented on a *small-scale* map without exaggeration, and consequent inaccuracy, introduced for the purpose of giving pictorial effect. Whether that effect is produced by a drawing made in the office, or upon the ground, appears to be of very trifling importance, so long as you have the means of ensuring the accuracy of the features by means of contour lines; at all events I think we are fully entitled to dispute Colonel Dawson's assumption, that, in this age of progress, the hill-drawings done by his father could not be exceeded either in beauty or value.

If Lord Monteagle were asked:—Would not a shaded map giving definite altitudes, as well as a pictorial representation of the country, be an improvement upon the Welsh map? I think there can be no doubt as to his answer. With the aid of the contour lines I believe this to be perfectly practicable, and that it will be eventually carried out.

I have not seen the Welsh hill-drawings, but those done under Colonel Dawson in Ireland do not exhibit any of the beautiful effects he portrays, or which were said to have been apprehended by Mr. Dawson. I do not say this to disparage those drawings; on the contrary, many of them are very good sketches, but, as compared with contours, their value is very small.

I must apologize for trespassing so long upon your time and putting forward these views unasked. A strong sense of the value of the work, and conviction that, even if now abandoned, it will ere long be again resumed at considerable expense and inconvenience, must plead my excuse.

CAPT. W. DRISCOLL GOSSET, R.E. to LIEUT.-COLONEL HALL.

Ordnance Map Office, Southampton,
June 10, 1853.

In obedience to your order to report on the subjects referred to in the accompanying printed correspondence, especially as relating to Scotland; also the result of my late examination into the value of the tithe maps of England for incorporation into a general map of the Kingdom, I have the honour to submit the following remarks:—

In the able memorandum by Mr. Charteris, at page 20 of the Treasury papers, there appears this paragraph:—

“Six-inch maps would indeed appear to be either too large or too small. For the general purposes for which maps are ordinarily used they are unquestionably too large; for plans of estates, and for most civil purposes, they are as unquestionably too small, estates being generally mapped on the scale of three chains to the inch, equal to $26\frac{2}{3}$ inches to the mile, or more than four times the size of the six-inch scale, which it must be remembered was not originally adopted as the scale best suited for all local and civil purposes to which a detailed and accurate survey is applicable, but solely as a scale sufficient for the townland boundaries.”

Though quite concurring with Mr. Charteris in the opinion that six-inch maps are too small to meet every *property* purpose (and indeed the community should feel indebted to Mr. Charteris for his suggestion of a larger scale and the great interest he has taken in the question), yet I must, with much deference to him, add my humble testimony in favour of the six-inch, as a scale of the utmost value for *other general purposes*. The term “general purpose for which maps are ordinarily used” is liable to so much uncertainty that I would recur to Major Larcom's valuable definition of the purpose to which six-inch maps are peculiarly applicable, viz., “*those purposes which require detailed local topography for public objects*.” These purposes are so many and so important that they cannot be considered otherwise than “*general*,” and the six-inch maps, as is I think now clearly shown by an overwhelming majority of evidence, (much of it evolved since Mr. Charteris's Committee), have answered these purposes so effectively (vide letters of Park, Griffith, Larcom, Vignoles,

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Rankine, Leather, Vans Agnew, Bateman, Piazzzi Smyth, &c.) that I must beg leave to differ from Mr. Charteris as to the six-inch scale being *too large*; in fact, the Under Secretary for Ireland, and many practical engineers who have used the map extensively, testify to its *peculiar* applicability (and prefer it to either a larger or smaller scale) for most general purposes; and, "though it was not originally adopted as the scale best suited for all the local and civil purposes to which a detailed and accurate survey is applicable," yet, *having been found to satisfactorily answer* very many important purposes, this scale, so valued, and of which we have in practice experienced such great benefit, should not, I respectfully submit, be set aside on the ground of insufficiency for general purposes.

The question appears to resolve itself into scale for general statistical and engineering purposes, versus scale for property purposes.

For property purposes the six-inch scale is undoubtedly too small, though it may not be out of place to mention a case to show in how very much greater a degree than is supposed it meets some of these purposes.

Being directed to turn my attention to the subject of registration of property, I took up four adjoining sheets, containing 65 square miles of the county of Wigtown, comprising in them a town and villages, and by the kindness of the proprietors was enabled to show the actually existing boundaries of all properties on the six-inch engraved maps, using only eight marginal drawings on a larger scale to render the registration and references complete; (the town and villages were of course registered on exceptional scales of their own).

The six-inch being admitted to be too small to subserve *all* individual property purposes, but being highly approved of for the other general and engineering purposes, it would seem desirable to select, if possible, such an increased scale as should fulfil the property purposes, and yet not fail for so many other general purposes.

I believe that the twelve-inch would be the most desirable scale to adopt for the arable counties of Scotland, as it would fully serve all private-property purposes, and yet retain in a considerable degree the attributes of a general and engineering map, which any larger scale would totally lose.

Mr. Charteris seems to think that the scale of $26\frac{2}{3}$ inches is the general scale for private-property plans. This may be so to a great extent in England, and the use of a scale, so needlessly large in ninety-nine cases out of a hundred has no doubt become too common a practice, but in a great measure from the following unreasonable causes: that ordinary property surveys are so often indifferently made, that imperfect construction (the want of a triangular basis, coarse workmanship, &c.) is endeavoured to be compensated for by an otherwise unnecessary increase of scale, employers believing that the larger the plan the greater the probability of its being more carefully made, and a disposition on the part of the inferior surveyors, to force on their employers the largest scale they can possibly induce them to receive.

In Scotland however, that scale *is by no means the general scale*, as I judge from some years' professional experience in that country. There is no general scale that I know of; but the majority of property plans in the most arable districts of Scotland will, I believe, be found to be on somewhere about the fifteen-inch scale.

Every inch of increase in the scale that can be avoided is of importance: the fact may not be known, that after a certain point the cost increases in an increased ratio to the increase of the scale, and it should never be forgotten that the bulk increases in the square of the scale. The Committee of 1851 in their report, comment upon the size of the six-inch map. The twenty-four-inch would be sixteen times as large! Even the twelve-inch will occupy four times the space on paper that the six-inch would require.

In page 23 Mr. Charteris seems rather disposed to recommend the twenty-four inch scale for the drawn plans, with a reduction to twelve inches for the engraved plans for publication, founding this recommendation principally on Lieut.-Colonel Dawson's advice, and quoting a letter of 1837 from the Tithe Commissioners (alias Lieut. Dawson), viz., "Unless the contents of fields can be computed from the map itself and compared with the book of reference sent with it, there is no real security for the correctness of either of these documents." Now if a $26\frac{2}{3}$ -inch scale be the smallest scale from which areas can be computed, of what use is it to give the public a twelve-inch map (from which Lieut.-Colonel

Dawson supposes they *cannot* compute their areas) for comparison to obtain that real security above-mentioned? The statement about areas and the proposal to publish a twelve-inch map seems incongruous.

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The twelve-inch scale is larger than necessary for general purposes; the only ground upon which it should be adopted is for property purposes, but if too small to give areas, it would fail in one of the first and chief desiderata of property maps.

It is true that Mr. Charteris, guided by Lieut.-Colonel Dawson, advocates manuscript plans on a twenty-four-inch scale, and a published map on a twelve-inch, on the plea that those who choose to pay extra for special traces or plans on the twenty-four-inch scale, may obtain them; but it seems to me, setting aside the extravagance of the twenty-four-inch scale for ordinary Scotch rural districts, that the principle of producing costly work, and then putting it on the shelf to be only used on application and payment by the parties, instead of publishing it at a cheap price, is contrary to the principles which ought to guide a great public work. In the first place, it is quite certain that people will work by the published scale, whatever that scale may be;—only a few will seek an unpublished document; and I do not think that the Nation should pay for, and the progress of the general survey be retarded by, plotting and drawing every thing on the twenty-four-inch scale, and reducing it all to the twelve-inch (three costly operations), to meet the possible wants of a few exceptions; and, in the next, stowing away perishable paper documents is insecure.

If it be necessary to make twenty-four-inch plans, then they should be secured by engraving. Publicity, and the multiplication of *bonâ fide* similar copies (which engravings must be, but manuscripts may not,) add infinitely to the authenticity of plans, and to their legal value in property causes.

But it is my firm opinion that the twenty-four inch scale is *not* necessary for the arable districts of Scotland. I cannot but consider that to make twenty-four-inch plans of the whole of the cultivated districts of the country, would be to mis-spend time, and to throw money away; and I feel convinced that a twelve-inch map, in manuscript and for publication, will fulfil all property purposes in Scotland. Villages and towns, of course, to be on exceptional scales; and I am supported in my view by the following considerations:

1. The scales of the generality of present property plans in Scotland range about fifteen inches; many are on less scales. Lieut.-Colonel Dawson, in conversation with me on the subject, admitted that he would receive a plan made by the Ordnance on a scale some inches smaller than he would one of the same district, made by the generality of private surveyors. Thus, considering fifteen inches as the average scale for private surveys in Scotland, he could not, by the same reasoning, refuse to accept for it twelve-inch Ordnance Survey Plans.

2. The Law Amendment Committee of 1847, decided that a $18\frac{1}{2}$ -inch map would give "the Government and the community such accurate information as to the extent, the character, and the divisions of the surface of the country, as might facilitate the conveyance of real property, the administration of justice in disputes concerning boundaries, and generally rendering more accurate and more easy all transactions affecting the land of the country." If this Committee, after a searching inquiry, considered $18\frac{1}{2}$ large enough for England, in all these important cases, surely a twelve-inch scale will answer completely for Scotland.

3. The Tithe Commutation Office have, according to Lieut.-Colonel Dawson's own admission, accepted and worked with the $18\frac{1}{2}$ -inch scale on a large proportion of their maps.

4. The reduced general map of London for the Commissioners of Sewers has been engraved specially for that body on the twelve-inch scale, and I presume that it was selected with all due consideration.

5. In the draft of Mr. Headlam's bill to facilitate the sale and purchase of land, the scale proposed is ten inches.

6. It is admitted that the twelve-inch scale is sufficiently large to show all details with the necessary clearness, as it is the scale now proposed for the published maps, and we are informed by Mr. Vignoles that it is the scale in Bavaria and France, &c. If, then, by the superior construction and superior minuteness of the Ordnance Survey, a twelve-inch scale will also give the requisite areas, there is no necessity for a larger scale. That twelve-inch Ordnance Maps of the arable districts of Scotland will give areas with all the accuracy expected for practical property purposes, I have little doubt.

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7. In obedience to your orders, I carefully examined, and in many ways tested, a number of the picked best first-class tithe commission maps made by private surveyors; the result of my examination is the discovery that they are utterly worthless for incorporation into a general map of the Kingdom. As to the second-class maps, the officials at the Tithe Office did not deem it worth my while to examine them, so inferior did they consider them. Portions of first-class maps here and there would, and perhaps even a few whole plans might, be found good; but it would undoubtedly cost more to examine and make certain of the accuracy of these very very small fractions, and to cobble at and patch the scraps into their places, than to throw the whole overboard bodily.

As to passing small mistakes to try and use up indifferent work,—once open the door to a *degree* of inaccuracy, and there will be no knowing where trifling imperfections shall not become glaring errors, and the national survey dwindle into an indifferent compilation. Twelve-inch maps constructed on the Ordnance system of triangulation could be *safely guaranteed* to give better areas, than the areas given by the generality of the 26 $\frac{2}{3}$ -inch tithe maps, (these tithe areas have hitherto, I suppose, satisfied the Tithe Commissioners).

8. Lieut.-Colonel Dawson urges the propriety of making twenty-four-inch manuscript plans for England, but he subsequently confesses himself ignorant of any difference existing between the nature of the countries,—England and Scotland,—which should influence the present question. Now it is notorious that even the arable part of Scotland (that for which a large scale is proposed) is not cut up into such small properties, nor is the face of the country subdivided into such small inclosures, nor are the public boundaries so numerous nor so intricate, as in England. If differences in the closeness of boundaries, details, properties, &c. &c. are not to affect the considerations on the subject of scale, why is a one-inch scale proposed for the open districts of Scotland? why a ten feet for towns?

9. Lieut.-Colonel Dawson asserts that public opinion is in favour of the twenty-four-inch scale; my late residence in Scotland, and rather extensive acquaintance with its landed proprietors and professional men, enables me to affirm that in a large portion of that country such a feeling has no existence, as an appeal to the counties will doubtless show; many are, I know, decidedly opposed to so large a map, the execution of which must be a very slow operation, and for which possibly no Chancellor would vote funds.

Lastly. A twelve-inch map would be of considerably more *general* use to the community than a twenty-four inch. Upon the former, inquirers would still have some power of using the maps for railway and other purposes, and individuals the facilities for devising and adding extensive property improvements, &c., which the twenty-four-inch scale sheets, from their limited embrace, would not afford.

On the question of scale so many elements come into play, so many interests have to be considered, it is not surprising that opinions vary. The talented Under-Secretary for Ireland, who combines with scientific attainments of the highest order, a practical and varied experience in geographical and surveying subjects, second to none in the Kingdom, tells us, that we cannot find any one scale to subserve all possible purposes. But on the question of the utility of contours, 1st, to exhibit the form of ground in large scale plans; 2d, as a basis for a more pictorial delineation of features in the reduced maps; I confess myself unable to discover any reasonable points for argument.

To those who understand and can read contouring, a contoured plan gives definite information; it models the ground to the mind's eye with a fidelity no other known scheme can approach. It gives the means for making true sections in any required direction, which neither scattered levels nor shading of any sort can possibly afford; in fact, there is a mechanical *certainly* conveyed by contours, which no other system of hill portraiture can equal.

With such an array of strength on my side as great Humboldt's verdict, "that contours are the only true and perfectly correct method of representing the conformation of the surface of a country," I am emboldened to state my views on this subject without hesitation.

Professor Bergaus has adopted contours in his works, and the well-known physical atlas of Johnston contains a map of the mountain systems of Europe which is based on these lines.

It is said against contours, that they do not convey so ready an idea of the physical relief as hill shading suggests. On large scale maps shading is out of the question; contours are therefore unavoidable, if form is to be given at all. On the one-inch map contours alone do not perhaps always strike the eye at a cursory glance, but though, perhaps, unsatisfactory for a hurried consultation, yet, when studied for some little time, they are infinitely more instructive than any hill shading.

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Contours possess another advantage; they must be *correct*, hill sketching may not, and too often is not, as we know from discoveries in the English work.

Without the occasional aid of contours, hill sketching depends solely on the *opinion* of the sketcher, thus it is found that no two persons will ever sketch the same piece of ground with precisely the same results; one apprehends it in one way, and another in another; the contours, or lines of the same level, must, on the contrary, though done by different persons, agree exactly; contours, therefore, become the very best possible data for a hill sketcher or a hill draftsman.

Puissant's volume on topography, written more than thirty years ago, and wherein every device for hill shading, by oblique and vertical light, &c., is fully discussed, teems with the mention of contours as the best foundation for indicating the different convolutions of the ground, shading being employed with them solely to add a pictorial effect.

The pictorial effect of hachure etching, with an artistic play of light and shade, no doubt captivates the eye, and from being the commonest method of showing hills, pleases the general public. There seems to me to be no reason why the public taste should not be gratified, and the requirements of the man of science and engineer be at the same time complied with.

Having just mastered the new method of producing an electrotype duplicate plate from an original in a few hours, instead of, as formerly, in a few weeks; it would be easy to so produce a duplicate of the hill shaded plate, and upon this duplicate add the contour lines; or, if it be preferred, put them upon a duplicate taken before the hill shading is done upon the original; each party could then suit their own tastes.

The above is proposed on the assumption that the contours will still be continued in the lowland districts, and occasional contours in the higher grounds. Unless they are so, the one-inch map of Scotland will be liable to the errors inseparable from ordinary hill sketching, namely, from misapprehension of the features, and the laxity of too great an artistic license.

Contours confine the errors within certain limits, and though contours could not imbue a hill shaded copy with the rigorous precision belonging to themselves, they convey the truest possible idea to the draftsman, whose sagacity and skill is thus aided to the utmost.

The *confidence* contours give a draftsman cannot be exceeded, nay, cannot be equalled by any hill-sketch. A hill-sketcher apprehends a form, and he pictures it to the best of his ability, he gives his sketch a *meaning*; the draftsmen then must try to grasp that *meaning*, in this there is an amount of uncertainty—two errors thus come into play.

Contours, on the contrary, besides being accurate, have but *one meaning*. Ten different people must read them alike; there is no latitude for doubt.

No clever artist who has once drawn hills from contours would ever prefer a hill sketch without them. They are the truth which he embellishes, certain that whilst he adheres to their dictation, he portrays his forms with the nearest approach to reality that the power of his pencil will permit.

Whether one system of light and shade, or another is to be adopted, all being well known, the Superintendent of the survey should, I presume, determine. The "*ombres portées*" of Puissant may be effective, but they may not be practicable in engraving—oblique light may be feasible in one district, a modification of it might better suit another; but these are details which must have ere this been well considered on the Survey, and therefore any discussion on such minutiae would be superfluous.

In conclusion, I beg to recommend, 1st, The twelve-inch scale for the manuscript and published map of the arable rural districts of Scotland, provided that that scale be considered sufficient to give the required areas for all property purposes. If not sufficient, the general map to be on the six-inch scale; the survey to be made to plot on a larger scale, but not to be laid down on that scale unless

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especially demanded. 2nd, Villages and towns to be on the two feet, five feet, or ten feet scales, according to their closeness and extent. 3d, Contouring to be decidedly continued as usual on the twelve-inch or six-inch map, and occasional contours as a basis for the hill-shading of the one-inch map. 4th, An original and duplicate of the plate of the one-inch map to be published. The one hill shaded, the other with the contours added to it.

SECOND LETTER from the TREASURY,
referring also to Decimal Scales.

Second Circular
from the Treasury,
referring also to
Decimal Scales.

(Circular.)

Treasury Chambers, 16th January 1854.

I AM commanded by the Lords Commissioners of Her Majesty's Treasury to convey to you their thanks for your answer to their previous communication on the subject of the Ordnance Survey, and to request that you will, at your earliest convenience, inform them which of the under-mentioned scales you would recommend, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which Surveys and Plans are usually made, viz. :

- 1st. A scale of twenty-four inches to the mile for rural, and of ten feet to the mile for town districts :
- 2d. A scale of three chains to the inch, or $26\frac{2}{3}$ inches to the mile, for rural, and of ten feet for town districts ; or,
- 3d. Scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped, i.e. the scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns, as recommended by the Statistical Society of London, and the Statistical Conference at Brussels; those being the fractions now in general use on the continent of Europe, and nearly equivalent to the scales of 2 feet $1\frac{1}{2}$ inches to the mile for rural districts, and 10 feet $6\frac{2}{3}$ inches to the mile for towns.

My Lords request that you will further state your opinion whether the adoption of these decimal scales would be productive of any practical inconvenience.

I have, &c.
(Signed) C. E. TREVELYAN.

ABSTRACT of REPLIES to the Treasury Circular, 16th January 1854.

Abstract of Replies
to the Treasury
Circular,
16th January 1854.

1. In favour of scales of 24 inches and ten feet to a mile.
2. In favour of scales of $26\frac{2}{3}$ inches and ten feet to a mile.
3. In favour of scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped.
4. In favour of other scales.
5. That the decimal scales would be productive of practical inconvenience.

	1.	2.	3.	
	In favour of Scales of 24 Inches, and Ten Feet to a Mile.	In favour of Scales of $26\frac{2}{3}$ Inches, and Ten Feet to a Mile.	In favour of Scales bearing a definite Proportion to the Linear Measurement of the Ground.	
1	Mr. A. Hunter.	Mr. Charles Neale.	Mr. H. Bellenden Ker	1
2	Mr. S. C. Homersham.	Mr. E. W. Wilmot.	Mr. Thomas Sopwith.	2
3	Mr. Henry Badcock.	Mr. B. Badcock.	Captain W. S. Moorson	3
4	Major Simmonds.	Messrs. Pickering & Smith.	Mr. E. W. Wilmot.	4
5	Mr. Charles Osborn.	Mr. John Dickson.	Mr. L. D. B. Gordon.	5
6	Mr. William Murton.	Messrs. Hyde & Co.	Professor Whewell.	6
7	Sir Walter Trevelyan, Bart.	Mr. Charles Hide.	Mr. Charles Babbage.	7
8	Lieut.-Col. Stopford Blair.	Messrs. Newton & Woodrow.	Mr. J. Meadows White.	8
9	Mr. Richard Griffith.	Mr. R. Peyton.	Sir David Brewster.	9
10	Mr. Samuel Hughes.	Mr. John Neighbour.	Mr. A. Petermann.	10
11	Mr. David Stevenson.	Mr. J. H. Cotterell.	Mr. A. M. Dunlop, M.P.	11
12	Mr. Thomas Wicksteed.	Mr. W. Heard.	Mr. G. B. Greenough.	12

**Abstract of Replies
to the Treasury
Circular,
16th January 1854.**

	1.	2.	3.	
	In favour of Scales of 24 Inches, and Ten Feet to a Mile.	In favour of Scales of 26 $\frac{2}{3}$ Inches, and Ten Feet to a Mile.	In favour of Scales bearing a definite Proportion to the Linear Measurement of the Ground.	
13	Mr. Philip Park.	Messrs. Wright & Son.	Messrs. Hyde & Co.	13
14	Mr. A. Keith Johnston.	Mr. William Brown.	Lord Wrottesley.	14
15	Mr. William Fairbairn.	Mr. James Forsyth.	Law Amendment Society.	15
16	Messrs. Davis and Vigers.	Mr. William Keen.	Mr. Charles Vignoles.	16
17	Sir Henry De la Beche.	Mr. William Dickinson.	The Astronomer Royal.	17
18	Mr. E. Hewett.	Mr. Moses Dodd.	Mr. Carleton Baynes.	18
19	Marquis of Tweeddale.	Mr. J. Bailey Denton.	Sr John Herschell, Bart.	19
20	Mr. Joseph B. H. Bennett.	Mr. C. M. Bidwell.	Mr. R. B. Grantham.	20
21	Mr. Edward Ryde.	Messrs. T. and H. Cooper.	Mr. T. Smith Woolley.	21
22	The Earl of Rosse.	Mr. T. W. Rammell.	Mr. Macquorn Rankine.	22
23	Mr. A. C. Ramsay.	Mr. David Stevenson.	Mr. F. O. Martin.	23
24	Mr. J. F. Bateman.	Mr. R. C. Gale.	Mr. Alexander Doull.	24
25	Mr. Robert Rodwell.	Sir Philip Egerton, Bart.	Mr. J. Beete Jukes.	25
26	Mr. James Johnstone, M.P.	Messrs. J. P. Sturge & Son.	Mr. T. W. Collard.	26
27	The Highland Society.	Mr. J. Marmont.	Mr. David Stevenson.	27
28	Mr. G. S. Duff, M.P.	Mr. Arthur Biddell.	Mr. F. W. Simms.	28
29	Lieut.-Col. H. Blair, M.P.	Mr. W. H. Apperley.	Mr. N. Beardmore.	29
30	Mr. James Duff, M.P.	Mr. J. Towne Danson.	Messrs. J. P. Sturge & Son.	30
31	Mr. J. F. Beattie.	Mr. Thomas Morris.	Mr. James Jerwood.	31
32	Mr. George Dundas, M.P.	Mr. J. A. Nockolds.	Principal of Glasgow College.	32
33	Mr. J. R. Haslam.	Mr. John Lancaster.	Deputy Clerk Registrar.	33
34	Mr. George Hewett.	Mr. C. F. Adams.	Mr. John Hawkshaw.	34
35	Messrs. T. & G. Chapman.	Mr. George P. Bidder.	Messrs. Fox & Henderson.	35
36	Professor Forbes.	Mr. John Watson, jun.	University of St. Andrews.	36
37	Professor Smyth.	Mr. J. Robison Wright.	Mr. John Hughes.	37
38	Mr. H. Lakin.	Mr. Thomas Bell.	Mr. Charles Bailey.	38
39	Lord Rosebery.	Mr. John M'Millan.	Town Surveyor of Norwich.	39
40		Mr. W. Bryan Wood.	Mr. William Fairbairn.	40
41		Mr. Alfred Giles.	The Registrar General.	41
42		Mr. Lucius H. Spooner.	Sir Henry De la Beche.	42
43		Mr. Samuel Vessey.	Mr. J. MacGregor, M.P.	43
44		Mr. William Gravatt.	Mr. Stephen Eddy.	44
45		Mr. J. K. Brunel.	Mr. George P. Bidder.	45
46		Mr. James Webb.	Mr. Henry M'Lauchlan.	46
47		Messrs. D. Smith & Son.	Messrs. Robert Pratt & Son.	47
48		Mr. George Hussey.	Rev. R. Sheepshanks.	48
49		Mr. John Fowler.	Mr. John M'Millan.	49
50		Mr. C. F. Cheffins.	Mr. William Ranger.	50
51		Mr. P. Brackenbury.	Mr. Joseph Gibbs.	51
52		Duke of Devonshire.	Mr. Jonathan Pim.	52
53		Mr. Joseph Locke, M.P.	Right Hon. E. Strutt.	53
54		Mr. William Price.	Mr. Thomas Page.	54
55		Mr. James Simpson.	Mr. Josiah Parkes.	55
56		Mr. A. Smollett, M.P.	Viscount Ebrington.	56
57		Mr. J. P. Lofthouse.	Mr. Thomas Thurston.	57
58		Mr. Walter Coulson.	Mr. James Rendel.	58
59		Professor Forbes.	Mr. W. C. Mylne.	59
60		Mr. John Bravender.	Lord Lovat.	60
61		Mr. Thomas Huskinson.	Lieut. Colonel Larcom.	61
62		Mr. H. J. Castle.	Mr. W. Fosbrooke.	62
63			Mr. C. F. Humbert.	63
64			Hon. Charles Gore.	64
65			Mr. James Saunders.	65
66			General Board of Health.	66
67			Mr. James Walker.	67
68			Lord Hatherton.	68
69			Colonel Everest.	69
70			Professor Forbes.	70
71			Captain Vetch, R.E.	71
72			Mr. E. H. Craufurd, M.P.	72
73			Inclosure Commissioners.	73
74			Mr. W. Haywood.	74
75			Mr. J. Hill Williams.	75
76			Mr. H. Lakin.	76
77			Commissioners of Sewers.	77
78			Mr. W. E. Gaine.	78
79			Mr. Henry Warburton.	79

Abstract of Replies to the Treasury Circular, 16th January, 1854.

4.

IN FAVOUR OF OTHER SCALES.

No. in Series.	Treasury Register Number.	Date.	Parties Replying.	Rural Districts.	Towns.
				Inches to a Mile.	Inches to a Mile
1	1,496	21 January 1854.	Sir William Cubitt - -	20	80
2	1,698	23 " "	Messrs. Clutton - -	20	—
3	1,888	24 " "	Mr. Richard Hall - -	20	—
4	2,306	27 " "	Mr. James Deering - -	27	—
5	4,154	23 February "	Mr. Peter Bruff - -	(a)	—
6	4,250	24 " "	Sir John Rennie - -	6	24
7	4,360	27 " "	Mr. James Walker - -	6	6
8	4,581	" " "	Lieut.-Gen. Sir C. Pasley -	6, 12, & 24	60
9	4,675	1 March "	Colonel Oliver - -	6 or 8	—
10	4,676	2 " "	Mr. J. B. McClean - -	16	—
11	5,273	10 " "	Sir Denham Norreys, Bart. -	20	—

(a) "Relative Scales suited to the nature of the district."

5.

That the adoption of the DECIMAL SCALES would be productive of practical inconvenience.

That the Decimal Scales would be practically inconvenient.

L. A. signifies Land Agent; L. S., Land Surveyor; C. E., Civil Engineer.

	WOULD.	WOULD NOT.	
1	Mr. Charles Osborn, L. A.	Mr. H. Bellenden Ker.	1
2	Sir Walter Trevelyan, Bart.	Mr. C. Neale, L. A.	2
3	Mr. Samuel Hughes, C. E.	Mr. Thomas Sopwith, L. A. and S.	3
4	Mr. A. Keith Johnston.	Captain W. S. Moorsom, C. E.	4
5	Mr. William Fairbairn, C. E.	Mr. L. D. B. Gordon, C. E.	5
6	Messrs. Davis and Vigers, L. A.	Mr. C. Babbage.	6
7	Mr. E. Hewett, L. A.	Mr. J. Meadows White.	7
8	Mr. E. Ryde, C. E. and S.	Sir David Brewster,	8
9	Mr. James F. Beattie, L. S.	Mr. A. Petermann.	9
10	Mr. George Dundas, M. P.	Mr. A. Hunter, L. A.	10
11	Mr. John R. Haslam, L. S.	Mr. A. M. Dunlop, M. P.	11
12	Mr. George Hewett, L. S.	Mr. G. B. Greenough.	12
13	Messrs. T. and G. Chapman, L. A.	Messrs. Hyde and Co., L. S.	13
14	Professor Smyth.	Mr. S. C. Homersham, C. E.	14
15	Mr. Henry Lakin, L. S.	Messrs. Newton and Woodrow, L. S.	15
16	Mr. B. Badcock, L. S.	Mr. Henry Badcock, L. S.	16
17	Messrs. Pickering and Smith, L. A.	Lord Wrottesley.	17
18	Mr. Charles Hide, L. S.	Law Amendment Society.	18
19	Mr. John Neighbour, L. S.	Mr. Charles Vignoles, C. E.	19
20	Messrs. Wright and Son, L. S.	Professor Airy.	20
21	Mr. Moses Dodd, L. S.	Mr. J. H. Cotterell, L. A. and S.	21
22	Mr. Charles Bidwell, L. S.	Mr. Carleton Baynes, C. E.	22
23	Messrs. T. and H. Cooper, L. S.	Major Simmonds.	23
24	Mr. T. W. Rammell, C. E.	Sir John Herschel, Bart.	24
25	Mr. Richard Gale, L. S.	Mr. R. B. Grantham, C. E.	25
26	Mr. J. Marmont, L. A.	Mr. T. S. Woolley, L. A.	26
27	Mr. Arthur Biddell, L. A. and S.	Mr. James Forsyth, L. A.	27
28	Mr. W. H. Apperley, L. A. and S.	Mr. William Keen, L. A.	28
29	Mr. John Towne Danson.	Mr. W. Macquorne Rankine, C. E.	29
30	Mr. Thomas Morris, L. S.	Mr. W. Dickenson, L. S.	30
31	Mr. John Lancaster, L. A.	Mr. F. O. Martin.	31
32	Mr. J. Robison Wright, C. E.	Mr. A. Doull, C. E. and S.	32
33	Mr. Thomas Bell, L. S.	Mr. J. Bailey Denton, L. S.	33
34	M. Alfred Giles, C. E.	Mr. T. W. Collard, L. S.	34
35	Mr. I. K. Brunel, C. E.	Mr. David Stevenson, C. E.	35
36	Mr. James Webb, L. S.	Mr. N. Beardmore, L. S.	36
37	Messrs. Daniel Smith and Son, L. A.	Mr. T. Wicksteed, C. E.	37

That the Decimal
Scales would be
practically
inconvenient.

	WOULD.	WOULD NOT.	
38	Mr. George Hussey, L. S.	Messrs. J. P. Sturge and Son, L. A. and S.	38
39	Mr. John Fowler, C. E.	Mr. James Jerwood.	39
40	Mr. Charles F. Cheffins, L. S.	Deputy Clerk Registrar.	40
41	Mr. P. W. Brackenbury, L. S.	Mr. John Hawkshaw, C. E.	41
42	The Duke of Devonshire.	Messrs. Fox and Henderson.	42
43	Mr. Joseph Locke, M.P.	Mr. Philip Park, C. E.	43
44	Mr. James Simpson, C. E.	University of St. Andrew's.	44
45	Mr. John P. Lofthouse, L. S.	Mr. J. Hughes, C. E.	45
46	Mr. Walter Coulson.	Mr. Charles Bailey, L. A.	46
47	Mr. Thomas Huskinson, L. A.	Town Surveyor of Norwich, L. S.	47
48	Mr. Beete Jukes.	Mr. C. F. Adams, L. S.	48
49	Mr. F. W. Simms, C. E.	The Registrar General.	49
50	Mr. Thomas Thurston, L. S.	Mr. J. M'Gregor, M.P.	50
51	Sir William Cubitt, C. E.	Mr. Stephen Eddy, L. A.	51
52	Mr. J. B. McClean, C. E.	Mr. H. M'Lauchlan, L. S.	52
		Messrs. Pratt and Son, L. S.	53
		Rev'd. R. Sheepshanks.	54
		Mr. John M'Millan, L. A.	55
		Mr. W. Ranger, C. E.	56
		Mr. Joseph Bennett, L. A.	57
		Mr. Joseph Gibbs, C. E.	58
		Mr. Lucius Spooner, L. A.	59
		Mr. Jonathan Pim.	60
		Right Hon. E. Strutt.	61
		Mr. Thomas Page, C. E.	62
		Mr. Josiah Parkes, C. E.	63
		Viscount Ebrington.	64
		Mr. William Gravatt, C. E.	65
		Mr. J. B. Bateman, C. E.	66
		Mr. James Johnstone, M.P.	67
		Mr. James Rendel, C. E.	68
		Mr. W. C. Mylne.	69
		Finance Committee, Inverness.	70
		Lieut.-Colonel Larcom, R. E.	71
		Mr. W. Fosbrooke, L. S.	72
		Mr. C. F. Humbert, L. A. and S.	73
		Mr. A. Smollett, M.P.	74
		Sir John Rennie, C. E.	75
		Hon. Charles Gore.	76
		Mr. Peter Bruff, C. E.	77
		Mr. James Saunders, L. S.	78
		General Board of Health.	79
		Lord Hatherton.	80
		Colonel Everest.	81
		Mr. John Bravender, L. S.	82
		Captain Vetch, R. E.	83
		Mr. E. H. Craufurd, M.P.	84
		Inclosure and Tithe Commissioners.	85
		Mr. William Haywood, C. E.	86
		Mr. J. Hill Williams.	87
		Mr. H. J. Castle, L. S.	88
		Metropolitan Commissioners of Sewers.	89
		Mr. W. E. Gaine, L. S.	90
		Mr. Henry Warburton, F.R.S.	91

R E P L I E S

IN FAVOUR OF

The 24 Inches and Ten Feet Scales.

Replies in favour
of the 24-inches
and ten-feet scales.

1.

Mr. A. HUNTER, LAND AGENT, &c.

Edinburgh, 20th January 1854.

I have had the honour of receiving your letter of the 16th instant.

I consider the first scale mentioned in your letter the best, as being the smallest, for rural districts.

I see no great objection to the third scale, excepting the additional expense, as already many of the surveys having been made on the six inches scale, for rural districts, they could not be so easily converted into 2 feet $1\frac{1}{2}$ inches; at the same time, as we are more accustomed to feet and inches, I think we ought to adhere to them.

No. 2.

Mr. S. C. HOMERSHAM, CIVIL ENGINEER.

London, 19 Buckingham Street, Adelphi,
January 23, 1854.

I have the honour to acknowledge the receipt of your Lordship's communication, dated the 16th instant, on the subject of the Ordnance Survey.

Confining my answers to the questions asked in your Lordship's communication, namely, which of the three series of scales named by your Lordships I should select for surveys and plans of rural and town districts? Judging from my own experience in making use of the Ordnance and parish surveys already executed for England, the Ordnance Surveys of Ireland, and the surveys in common use in Belgium and Prussia, I would answer that it is of no practical importance which of the three before-named series of scales are adopted. I should, however, prefer the first series named in your Lordships communication, namely, the scale of twenty-four inches to the mile for rural, and of ten feet to the mile for town districts.

I am led to prefer the above-named scale, because the Ordnance Surveys already published to the scales of ten miles to an inch, one mile to an inch, one mile to six inches for rural, and of one mile to a foot and one mile to five feet for town districts, would be much easier and more simply compared with the scales of one mile to two feet and one mile to ten feet than with either of the other two series suggested.

However, speaking for myself, and from experience in using the continental surveys to such scales as $\frac{1}{30000}$ and $\frac{1}{20000}$ and $\frac{1}{30000}$, I should anticipate no practical inconvenience worth consideration in using the scales of $\frac{1}{25000}$ and $\frac{1}{30000}$ as recommended by the Statistical Society.

I hope your Lordships will pardon my taking advantage of this opportunity of respectfully drawing your Lordships attention to the fact which I have often experienced, namely, that the existence of the Ordnance Survey of Ireland and part of the north of England to a scale of six inches to the mile by no means compensates engineers, geologists, and those engaged in designing large public works for the want of the shaded map to the scale of one mile to the inch published by the Ordnance for the south of England.

Replies in favour
of the 24-inches
and ten-feet scales.

No. 3.

MR. HENRY BADCOCK, LAND SURVEYOR.

St. Stephens by Launceston, January 23, 1854.

In reply to your Letter of the 16th Instant, relative to the Ordnance Survey, which I have the honour to acknowledge the receipt of, I beg to say that I am of opinion that the first scale mentioned, of twenty-four inches to a mile, is more than sufficiently large to set forth most distinctly and clearly all rural districts, and that ten feet would be so for the most thickly built town, and I should therefore recommend this scale as preferable to the others; but as maps of even this size are exceedingly cumbersome, I consider (taking the usefulness, convenience, and every other item into account,) maps of twenty inches to the mile for rural districts, and from six feet eight inches, to eight feet four inches to the mile for towns, more desirable than those on larger scales.

I can see no advantage in adopting scales bearing a definitive proportion to the linear measurement of the ground to be mapped, as in the third case; nor can I discover any practical inconvenience in the system.

There has been in general *in this district*, according to my view, a great defect in delineating the country in consequence of the fences (which are from six to nine feet wide) being seldom laid down or represented as they are; some persons taking the division line in the centre of the hedge, whilst others take it on one side or the other—some marking it, to show on which side it was taken. I would therefore recommend that the fences should be lined on both sides and clearly shown.

No. 4.

MAJOR J. H. SIMMONDS, H. E. I. C. S.

Bournemouth, 23 January, 1854.

In reply to your letter of the 16th instant, (received on Saturday,) I have the honour to submit, for the consideration of the Lords Commissioners of Her Majesty's Treasury, my humble opinion in reference to the subject of the proportional scales, first, second, and third, and based on primary principles, claiming the first consideration of a surveyor, namely economy of labour in office and field work, I take leave to observe.

1. The scale of twenty-four inches to the mile for rural, and ten feet to the mile for town districts, claims in my estimation a preference.

2. The scale of three chains to an inch, from its extensive application in tithe surveys, may in a measure claim consideration; at the same time I am free to admit I have no confidence in contract surveys.

3. The application of scales bearing a definite numerical proportion of linear measurement of the ground to be mapped, would not present any difficulty to the scientific surveyor; at the same time I am free to admit my doubts as respects such a change, should public convenience be consulted.

No. 5.

MR. CHARLES OSBORN, LAND AGENT.

Fareham, January 24, 1854.

I believe the opinion I before expressed that the first scale of 24 inches to the mile for rural, and of 10 feet to the mile for town districts would be most suitable for all purposes.

I consider the adoption of the decimal scale would be found inconvenient in the use of any present maps, and would occasion much additional trouble.

No. 6.

MR. WILLIAM MURTON, LAND AGENT.

Tunstall, January 23, 1854.

In reply to your circular of the 16th instant, I beg to say that as regards rural districts (to which I confine my opinion, having but little experience with

reference to town districts,) I prefer the scale of 24 inches as that of the draft plans to be preserved as public records; plans of half this scale being engraved for sale agreeably to what was proposed in your previous circular.

Replies in favour
of the 24-inches
and ten-feet scales.

I give this as my opinion thinking the 24 inch scale will give a sufficiently large map for practical estate purposes, and that half this scale should not be exceeded for the maps published for sale for local and distance reference, &c.

I think, too, that these even scales afford some advantage, seeing how generally the maps may be used by landowners, agents, and others, who not being land surveyors, cannot readily calculate or understand the distances represented.

Not being a surveyor, but merely a practical agent, connected with the management of estates, &c., I am sorry that I can offer no opinion with reference to the third of the scales mentioned in your circular.

No. 7.

SIR WALTER TREVELYAN, BART.

Edinburgh, January 24, 1854.

In answer to your communication of the 16th inst., I beg to state as my opinion, that a scale of *twenty-four* inches to the mile, would for most practical purposes, be the most useful for the survey of rural districts; were a copy on any other scale ever required, the drawing is, I believe, made so accurately, that it could at any time be readily copied, either on an enlarged or on a reduced scale; but for *engraving*, I believe that a scale of six inches to the mile would be quite sufficient.

In *uncultivated* or desert districts, I believe this scale to be larger than necessary, and that for many towns a scale of five feet to the mile would be satisfactory, though for the more important ones the proposed scale of ten feet would be desirable.

The adoption of the *fractional* scales would, I believe, be attended with practical inconvenience.

No. 8.

LIEUTENANT-COLONEL STOPFORD BLAIR.

3, Portman Square, London, January 24, 1854.

I have the honour to acknowledge the receipt of your circular letter of the 16th inst., (just received,) on the subject of the scale to be adopted by the Ordnance Survey. In reply, I beg to state that it is with the utmost diffidence I would wish to give an opinion on a subject on which I have not much practical experience; but, as far as I can do so, I still adhere to that of the first proposition, viz., 24 inches to the mile for rural, and 10 feet to the mile for town districts. Being, however, a strong advocate for the decimal scale generally, I should be glad to see it applied in this instance, if it can be done without objection—the difference of measure between No. 1 and No. 3 being insignificant, would not form any: although in this case it does not appear to be attended with the full advantage of the decimal scale, as a division of 5 and 25 is still required; but I am unable to say if it would be productive of any “practical inconvenience,” although I cannot imagine it likely to be so.

No. 9.

MR. RICHARD GRIFFITH, Commissioner for the General Valuation of Ireland.

Office of Public Works, Dublin, January 24, 1854.

I have had the honour to receive your letter of the 16th instant, requesting me to inform you which of three scales proposed I should recommend for the Ordnance Survey, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made.

G g

Replies in favour
of the 24-inches
and ten-feet scales.

In reply, I beg to state I should recommend the adoption of the first of the series of scales contained in the list, viz. :

A scale of 24 inches to the mile for rural, and of 10 feet to the mile for town districts.

The scale at present adopted for the Ordnance Survey of the northern districts of England being six inches to a mile, and the same scale having been adopted for the rural districts of the whole of Ireland, it appears to be desirable that any increase of the scale for future surveys should be a multiple of the scale of six inches.

In regard to the scale of 10 feet for towns, I think it will be a desirable scale, though I have found the scale of five feet to a mile quite sufficient for all the purposes of measurement and valuation in the several cities and towns in Ireland.

No. 10.

MR. SAMUEL HUGHES, CIVIL ENGINEER.

14, Park Street, Westminster, January 26, 1854.

In replying to the questions on which you have done me the honour to request my opinion, I shall first notice briefly the principal points which occur to me with reference to each of the scales referred to in your Lordships letter, and then state which of them I recommend in case it should be determined to publish the Ordnance Survey on a scale sufficiently large to comprehend all the objects for which surveys and plans are usually made.

With reference to the first scale, on which a mile is represented by 24 inches, I think this an exceedingly convenient and desirable one for large tracts of country.

The scale itself so nearly resembles that of 3 chains to an inch, that in a limited survey, such as that of an estate or a parish, I would as soon have one scale as the other. I think all the usual operations, such as marking subdivisions or other lines, computing areas, and so forth, may be as accurately performed on one scale as the other, and I think each scale, equally simple and convenient for surveyors and all others who have to use and work upon such maps.

But in seeking to decide on the best scale for a national survey, or for any survey of great extent which is to serve for all the innumerable purposes both scientific and commercial which will be promoted by such a survey, then I think the scale in which the well known measure of a statute mile is represented by an integral number of inches capable of easy division without remainder, has a decided advantage over the scale in which the inch is merely subdivided, and the mile represented by a fractional number of inches.

I may instance the Ordnance Surveys of England and Ireland, and a still more recent work, the skeleton plan of London prepared for the Commissioners of Sewers, in all of which the mile is represented by an integral number of inches, as examples of the extreme adaptation of such maps to extensive surveys.

I have had constant occasion during my professional avocations to use all these maps in exploring districts of country both for railway purposes, and in geological researches, and can testify with much satisfaction to the readiness with which the eye becomes accustomed to the spaces of the map, and to the position of the objects represented.

Taking the case of the large scale here proposed, where 24 inches are equal to one mile, it is remarkable how simple are the spaces which represent well known fractions of a mile; thus 12 inches, or one foot, will represent half a mile; six inches will represent one quarter of a mile, and three inches will represent one furlong, or the eighth part of a mile.

In the scales adapted for this map, a decimal division will here be required, and the 3 inches will be subdivided into 10 parts, each of which will represent a chain; each chain again being divided into 10 parts to represent decades of 10 links each, as usual on all the present scales.

In this facility of thus being able to estimate spaces equivalent to a mile, or any of its usual subdivisions, I recognize the chief advantage of the first scale over that in which the inch itself is divided into equal parts; at the same time I know, from practical experience of the most improved methods of computing

areas, that the slight difference in the two scales will in no perceptible degree diminish the accuracy with which areas can be ascertained.

Replies in favour
of the 24-inches
and ten-feet scales.

From the preceding considerations, I think unquestionably the scale of two feet per mile the best for a national survey; and although this would probably occasion surveyors to adopt this scale in their future surveys, the change would be perfectly simple and natural.

In place of supplying scales in which an inch is divided into thirty parts, (the scale employed for measuring maps, in which an inch represents three chains,) the instrument makers would have to divide three inches into a hundred parts, and precisely the same numbering to represent chains might be used as at present.

I have been a good deal in the habit of using maps where the scale is made by dividing the inch into any integral number of parts, ranging from two to twenty, and I see no inconvenience either to the maker or user of maps in adopting in lieu of these a uniform method of representing the mile by a definite number of inches.

There is another advantage in having all the national surveys multiples of each other which must not be lost sight of. In all cases of compilation and reduction there is great merit in such a simple proportion as that which obtains between the existing Ordnance Surveys; whilst the newly proposed scale would in its turn be exactly twenty-four times the size of the small English Ordnance, and exactly four times the size of the Irish Ordnance, of the map of Scotland, and of the northern counties of England.

There are many purposes, especially in connexion with agriculture and agricultural geology, for which maps on a large scale would be used, if such maps were readily accessible,—and having regard to all these purposes I see considerable advantage in the scale proposed.

With reference to those scales in which the map bears a definite decimal proportion to the actual surface, I see no advantage whatever in such a proposal, unless the lineal measures commonly in use were also converted into decimal measures, as on the Continent. For instance, in a country where one centimètre being multiplied 2,500 times becomes equal to twenty-five mètres, so that each centimètre on the map represents also twenty-five mètres, and four centimètres represent 100 mètres, &c., I can conceive a scale of $\frac{1}{2500}$ a very useful and valuable one, inasmuch as distances may be almost computed by the eye, or read off by any decimal scale. But in this country, we have no unit which, taken 2,500 times, represents any other known or recognized measure of length; and it would be highly unsatisfactory to multiply every space by a fractional number, in order to convert it to its equivalent length on the ground. If our measures of length, therefore, are to remain as they are, partly decimal and partly duodecimal, I think there would be no advantage whatever, but, on the contrary, very great inconvenience in adopting a decimal proportion between the plan and the actual country. It would require a much more extensive alteration of the measuring scales, and would be much less easy to estimate by the eye and to measure by any other than a scale specially constructed for the purpose.

If a complete alteration of our lineal measures, analogous to that proposed for the coinage, should ever be carried into effect, it might be necessary then to consider the expediency of such a proportion as that of one to 2,500; but as I do not understand from the terms of your Lordships letter that any such alteration is proposed, or that any opinion is requested in relation to it, I have thought it unnecessary at this time to consider the question.

To sum up my opinion as to this part of the subject, I think such a proportion as $\frac{1}{2500}$ would be useless, unless the known and usual measures were such that one could immediately convert some well-known, easily appreciated space on the map, such as the present inch, into its equivalent value on the ground, such equivalent value being also some well known and understood measure, such as a mile. Now, on a map where twenty-four inches represent a mile, such a conversion is most readily made, for most persons can very well carry in their eye a space of six inches, which represents a quarter of a mile.

Another argument in favour of the first two scales, as compared with the third, is the facility with which the accuracy of the measuring scales can be tested by reference to other measuring scales and to measures constantly in use, a process which would be found much more troublesome in the case of scales contrived to measure in the proportion of one to 2,500.

Replies in favour
of the 24 inches
and ten-feet scales.

With respect to town districts, I think the proportion of five to one a very judicious adjustment to the smaller scale required for rural districts, and I therefore conclude by recommending a scale of two feet to one mile for rural districts, and of ten feet for town districts.

No. 11.

MR. DAVID STEVENSON, CIVIL ENGINEER.

Edinburgh, January 24, 1854.

The three different sets of scales referred to in your letter of the 16th instant, are practically the same as regards *size*.

For engineering and surveying purposes, I am of opinion that the plans should have a scale of feet and a scale of chains, and if these scales are distinctly delineated on them, I do not see that it is of any material consequence which of the three scales alluded to in your letter be adopted.

No. 12.

MR. THOMAS WICKSTEED, CIVIL ENGINEER.

Leicester, January 25, 1854.

I have to acknowledge the receipt of your circular, respecting the scales for the Ordnance maps

My experience in these matters has been confined chiefly to maps in connexion with the supply of water to towns, and the result is as follows :

1st. I consider the present Ordnance map scale of one inch to a mile, quite sufficient for the purpose of determining the water-shed of a district, and it is a very convenient size to use in a general examination of the country.

2d. The present Ordnance map upon the larger scale of six inches to a mile, is sufficiently large in my opinion to lay down the general plan of the works and from which a general estimate of the cost of the proposed works may be made.

3d. For local plans upon an enlarged scale, which would have to be provided before carrying the proposed works into execution, I consider the first scale mentioned in the circular, namely, twenty-four inches to the mile for rural, and ten feet to the mile for town districts, the best of the three named.

But after all, as an engineer responsible for the execution of the works, unless I was satisfied that the surveyor who had made the particular survey and plan was fully competent to do so, I should not rely upon any published map, where the cost of the works depended upon the accuracy of the survey, and in such an event, should require a special survey before staking my professional character upon the correctness of my detailed estimate.

I do not see that any great inconvenience would arise from the adoption of the decimal scales; but to make them really useful the present imperial standard measures should also be altered, before any great benefit could arise from their adoption.

I do not, however, consider my opinion upon this question of much value, as it appears to me that the persons most interested in the question practically, are the surveyors engaged largely upon railway and other extensive surveys, to whom the adoption of any particular scale might prove of great practical convenience or inconvenience.

40, Coleman Street, London.

No. 13.

MR. PHILIP PARK, CIVIL ENGINEER.

Preston, January 25, 1854.

In compliance with the request of the Lords Commissioners of Her Majesty's Treasury expressed in your letter of the 16th instant, which I have had the honour to receive, asking which class of the scales therein specified I should recommend for adoption in the Ordnance Survey; I would beg respectfully to

refer you to my letter of the 20th August last on this subject, in which I ventured to recommend that the manuscript plans should be laid down to a scale of twenty-four inches to the mile for rural districts, and ten feet to the mile for towns.

Replies in favour
of the 24 inches
and ten-feet scales.

On reconsideration, I see no reason to alter this opinion, and should therefore recommend these two scales for adoption, which coincide with the first class of scales mentioned in your letter.

In answer to the question "whether the adoption of the decimal scales" (mentioned in the third class) would be productive of any practical inconvenience," I am not aware that any practical inconvenience worth notice could arise from their adoption.

No. 14.

MR. A. KEITH JOHNSTON.

Edinburgh, January 27, 1854.

In answer to your communication of the 16th instant, regarding a selection of one of three scales submitted to me for a proposed new survey of Scotland, I beg to state my opinion, that of the three, those first on the list—24 inches to a mile for rural districts, and ten feet for towns, would be the most desirable, because the 24-inch scale yields the current decimal proportion of $\frac{1}{2640}$ of the natural scale, and being 40 chains to a foot, or 10 chains to three inches, its introduction would not necessitate any alteration in the present mode of measuring land, or of referring to its previously measured area; while the 10-foot scale for towns gives the proportion of $\frac{1}{328}$ of the natural scale, and is equally simple and practical.

The adoption of the above-mentioned decimal scales could not, therefore, be productive of any inconvenience; but it appears to me that if those particular scales presented as the third alternative were fixed on, they would necessarily lead to great practical inconvenience in this country, because they yield indefinite, and therefore troublesome proportions when expressed in English inches to a mile. Thus the scale of $\frac{1}{2500}$ gives 25,344 inches to a mile, and that of $\frac{1}{300}$ gives about 126 $\frac{2}{3}$ inches to a mile,—both of them very indeterminate for reference, and unsatisfactory in practice. Neither of these objections apply to the 24-inch and 120-inch scales, which therefore combine the advantages of scientific precision with ordinary use.

In the event of a survey being made on either of these scales, I beg to repeat a former recommendation, to the effect that a certified copy of the original protraction should be registered and kept in Scotland, so that any one requiring a traced copy might have it on the payment of a small sum, as is customary in France.

No. 15.

MR. WILLIAM FAIRBAIRN, CIVIL ENGINEER.

Paris, January 28, 1854.

I regret having being absent from Manchester when your circular of the 16th arrived. As regards the Ordnance Survey, I am of opinion that 24 inches for rural, and 10 feet to the mile for town districts, would be preferable to the fractional scale, and for this reason, namely, that, unless the decimal system was adopted the same as in this country, I apprehend the fractional scale would be more generally useful to the English public. For statistical and other purposes connected with science, the same scale as used on the Continent would doubtless be preferable; but until that change is effected, I am of opinion that plain numbers will better accord with our English habits.

Replies in favour
of the 24-inches
and ten-feet scales.

No. 16.

MESSRS. DAVIS AND VIGERS, LAND AGENTS.

3, Frederick's Place, Old Jewry,
January 28, 1854.

We are in receipt of your communication of the 16th instant, on the subject of the Ordnance Survey, and in conformity with your request that we would state which of the three scales mentioned therein we would recommend for adoption, and whether in our opinion, decimal scales would be productive of practical inconvenience.

We beg, in reply, to inform you, that we still adhere to the opinion given in our letter to you of April last, and approve of your first scale; and

That decimal scales would for a time be productive of practical inconvenience.

No. 17.

SIR HENRY T. DE LA BECHE. C.B., F.R.S.

Geological Survey Office, 30 January, 1854.

With reference to your communication on the subject of certain scales for surveys and plans, mentioned therein, I would observe that, if a new general map of the British Islands were now, for the first time, about to be constructed, I should have little hesitation in recommending a scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns, or some one of that character.

As, however, the adoption of decimal scales of that character would introduce a very different kind of system from that hitherto adopted for the Ordnance maps of the British Islands, wherein the proportion of inches to miles is employed, I have some hesitation on the subject. The scale of 24 inches to the mile is one of $\frac{1}{2640}$ of reality, and in like manner that of 10 feet for towns is one of $\frac{1}{528}$. No doubt the map upon a scale of one inch to the mile could be readily prepared from that of $\frac{1}{2500}$ of reality; but the one would always have the awkwardness of being an irregular kind of reduction of the other. Moreover, measures of feet and inches are always at hand for roughly, but approximately, computing distances and areas, when the scales of maps are in some proportion of inches and feet to miles. It would not be difficult, certainly, to have scales (metal, ivory, or wood) made on purpose. No doubt also, for *very accurate work*, computing from wet impressions of maps would not be right, the shrinkage from the copper making frequently a material difference, so that errors arise from using exact measures; from metallic or other scales, upon such wet impressions, the more safe way being to employ the scale usually affixed in some manner to such maps.

On the whole, seeing that the scale of 24 inches to the mile would have reference to all the work hitherto executed for Great Britain and Ireland, and that it would be of the same character as the one-inch map of the British Islands, which it is to be hoped will be carried out for general purposes, I would recommend that scale, and the more especially as, with these advantages, one does not practically perceive any great advantage of a scale of $\frac{1}{2500}$ over $\frac{1}{2640}$ of reality. In like manner for the towns; as architects, builders, workmen, and others interested in buildings usually employ measures referring to feet and inches, a scale also referring to such measures appears to have practical advantages.

No. 18.

MR. E. HEWETT, LAND AGENT AND VALUER.

Winchfield Feb. 4, 1854.

In reply to your letter of the 16th January, I beg leave to state that, in my opinion, of the scales named, that numbered first is the best—the second being too large for practical purposes. But I think a far better scale than either of these is one, 20 inches to the mile, or 4 chains to the inch. This is now more used than any other scale, and is found quite minute enough for all purposes and not unwieldy. I think the adoption of the decimal scales named would be productive of much practical inconvenience.

No. 19.

MARQUIS OF TWEEDDALE.

Replies in favour
of the 24-inches
and ten-feet scales.

Yester, February 3, 1854.

I beg to acknowledge the receipt of the Treasury letter, dated 16th January 1854. In compliance with the desire contained in that letter, I would recommend that the first scale, of 24 inches to the mile for rural, and of ten feet to the mile for town districts, should be adopted for the map; but on the express provision that there should be also laid down on the map a corresponding scale of three chains to the inch, the chain being 66 feet.

The surveyors in Scotland, I am told, universally use a chain of 66 feet, and it would cause difficulties and loss of time if a change was made.

A map on this scale, kept as a Government record, would be of great benefit to the country.

No. 20.

MR. JOSEPH B. H. BENNETT, LAND AGENT AND VALUER.

Tutbury, Burton-on-Trent, January 31, 1854.

After considering this important matter in many points of view, and after several trials and calculations, I have come to the conclusion, that, taking all things into account, your first proposition of 24 inches, or two feet to a mile for rural districts, and another scale (five times as large) or 10 feet to the mile for towns, cannot be improved upon for public purposes. I see these two scales have been used for the Ordnance Survey of Derby, not long ago completed.

I should prefer, on some accounts, the scale of three chains, or $26\frac{2}{3}$ inches to a mile, to the 24 inches to a mile; but it would not bear the proportion of 1 to 5 to the towns' scale of 10 feet to a mile, which the 24 inches per mile does,—as the relative proportion would be 1 to $4\frac{1}{2}$ (instead of 5) between the rural and town scales, $26\frac{2}{3}$ inches per mile being $\frac{1}{9}$ larger than 24 inches to the mile. Therefore, if it were not for deranging the very good and convenient proportion of 1 to 5, I should prefer the larger scale of $26\frac{2}{3}$ inches to a mile to that of 24 inches; but it is so desirable to retain the relation of 1 to 5 instead of one to $4\frac{1}{2}$ between the two scales, that I would submit to the smallness (comparatively) of the rural scale, rather than disturb the proportion of 1 to 5, which I consider very good, and not to be improved upon.

You probably are aware that even three chains to an inch is generally considered as too small a scale where nicety and exactness of quantities are requisite. I have always objected to the three-chain scale for my surveys, on account of its being too small and too troublesome in the plotting, and not admitting of sufficient accuracy in casting the quantities; besides, there is the objection to the three-chain scale, that it reduces to nothing *even*, as 6 and 9 and 18 are nothing, whereas the scale of $2\frac{1}{2}$ chains to an inch, or 32 inches to a mile, is a better scale for practical purposes, where considerable accuracy is an object; besides, it reduces to 5, 10, and 20 chains in an inch, which are much better than 6, 9, and 18, which are no proportions of either tenths or miles.

Many persons go so far as to have not merely estates of one or two hundred acres, but whole parishes of 2,000 acres each, laid down by a scale of two chains to the inch, and consider that as not too large; and I am fully of opinion that, for private or parish uses, no survey should be plotted on a less scale than $2\frac{1}{2}$ chains to an inch, the three-chain being, for practice, too small for either plotting or casting quantities from. It is, however, not to be questioned that the scales of 2 and $2\frac{1}{2}$ chains to an inch are more troublesome to use for plotting and casting than the three-chain scale, because the plan will be larger and less convenient, and occupy more time in moving about and managing. The work, on a small scale, will be done quicker and more comfortably and conveniently than where the scale is large; there is less surface of paper to be moved, and it is quicker and more readily moved about when required. These are the disadvantages, and the only disadvantages, of the larger scales.

But, in looking from the surveying, &c. of private estates, or even parishes, to the survey of counties or kingdoms, the difference of quantity and extent

Replies in favour
of the 24 inches
and ten-feet scales.

should be taken into account, and have due weight. I have no idea that an Ordnance Survey, upon a scale of either 24 or $26\frac{2}{3}$ inches to the mile, would be relied upon in England for casting quantities from, where accuracy was required. Such surveys would be sufficiently near for many purposes, but not where nicety of measurement was wanted. I should never think of putting an Ordnance map of a country in competition with the work of a good and experienced private surveyor, who had worked for correct quantities as the primary matter, and for a plan subordinately, which is the case in all country surveys, for selling especially. True quantities is the first thing looked to, after which minute details are desirable in the lines, &c., though in the second place.

After this digression, which I hope may be excused, though I feel it may not be without its use under the circumstances, I must repeat that I am decidedly of opinion that no two better scales can be determined upon for the great purpose in view than the two feet to the mile, and ten feet to the mile, for the reasons I have before mentioned, and for many other reasons with which I will not now trouble you. In no measure can every good be found; the balance must be looked to upon the whole, and that must satisfy. The proportion between two and ten is very good, and the two feet to a mile, though not actually the best in some respects, will, almost to a certainty, prove very satisfactory if well carried out, and may, for general purposes and a majority of persons, be liked better than if it had been larger.

And lastly, as to the adoption of these decimal scales being productive of any practical inconvenience, I can see none. No other but decimal scales can be introduced in landsurveying. For whether the measuring line be feet, yards, or links, it must be subdivided into tenths, and worked wholly on the decimal principle; no quarters, eighths, or twelfths can be used in land measuring. And, after working a good deal to find out more useful or better scales than the two above mentioned, I am ready to admit I have not succeeded; and I am of opinion no person will succeed in improving upon them. They are freer from objections than any others I have heard of or thought of, besides possessing advantages which I consider their own.

No. 21.

MR. EDWARD RYDE, CIVIL ENGINEER AND LAND SURVEYOR.

Pimlico, February 6, 1854.

My attention has been directed to the copy of a letter dated January 1854, which has been published in the "Times" newspaper, and therein stated to have been addressed by you to the "most eminent civil engineers and surveyors," with the view of consulting them as to the scale upon which it would be most desirable to construct the "Ordnance maps," supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made.

Three sets of scales are named; viz.—1. 24 inches to the mile for rural, and 10 feet to the mile for town districts. 2. Three chains to an inch or $26\frac{2}{3}$ inches to a mile for rural, and 10 feet for towns as before. 3. $\frac{1}{2500}$ of reality for rural, and $\frac{1}{500}$ for town districts.

Not having received a copy of this letter I incur the risk of your displeasure in writing to you, unless, indeed, you consider the matter as one of public interest and national importance, upon which the suggestions of practical men are valuable.

I have had great practical experience in surveying, though perhaps, it has been under circumstances which has not brought my name before my Lords Commissioners of Her Majesty's Treasury; and my settled conviction is that of the three scales you have named, the scale of 24 inches to the mile is by far the best for rural districts, and 10 feet to the mile for towns; the advantages of the 24 inches to the mile over the three-chain scale being the following:

- 1st. That the public understand it better; few but surveyors knowing anything about the meaning of "three chains to an inch."
- 2nd. That the two scales of two feet and 10 feet are multiples of each other, a circumstance facilitating comparisons and reductions; and

3d. Because it causes no inconvenience to the surveyor in making comparisons with the existing Ordnance maps.

Replies in favour
of the 24 inches
and ten-feet scales.

To make the scales bear a numerical proportion to the linear measurement of the ground to be mapped, is not at all important for practical purposes, and would certainly tend to confuse the public much more than the scale of 24 inches to the mile. Every mechanic can understand the map if he is told that his two feet rule represents a mile thereon; but he would not so readily comprehend the numerical proportion of $\frac{1}{2500}$, and would be quite at sea, as to the three-chain scale.

Although I am of opinion that 24 inches to the mile is the best scale to plot to, I think 12 inches to the mile would be large enough for publication, and it would be more convenient, I mean for rural districts; for town districts much would depend upon the closeness of the matter delineated.

No. 22.

THE EARL OF ROSSE.

Castle, Parsonstown, February 8, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th of January. In my answer to your former queries (17th June 1853,) I recommended a scale of 20 inches to the mile, and while I still believe that such would be quite sufficient, I can see no objection to the 24 inch scale, as the expense of the field work for the additional details of the larger scale would not be considerable. Ten feet to the mile for town districts would be amply sufficient. As to the third query, I cannot speak with confidence, it is purely a question of convenience, and the only practical surveyors I have had an opportunity of consulting with at the moment, are decidedly of opinion that the 24 inch scale for rural districts; and the 10 feet for town districts would be preferable. I am speaking in ignorance of the grounds upon which the Statistical Society have founded their recommendation.

Having in my former letter stated pretty fully the principles I have kept in view in considering this question, I do not think it necessary to trouble you further on the present occasion.

No. 23.

THE LOCAL DIRECTOR OF THE GEOLOGICAL SURVEY.

Geological Survey Office, February 9, 1854.

In reply to your letter of the 16th January, after much consideration I am of opinion that of the three propositions for the Ordnance Survey, the scale of twenty-four inches to the mile for rural and ten feet to the mile for town districts would be most useful and convenient, in so far that all ordinary measures (scales of feet, &c.) now in use would be available in reference to the maps. I see no special advantage in three chains to the inch, nor yet in the scale of $\frac{1}{2500}$ for rural districts and $\frac{1}{5000}$ for towns, unless, with reference to the latter proposal, measures now in daily use were altered.

As local director of the Geological Survey, I considered it my duty in my previous letter to consider the subject "principally with reference to scales of the Ordnance Maps on the work of the Geological Survey of Great Britain." It may not be considered irrelevant to state the bearings of the proposed scales on this subject, especially as it is not mentioned in your letter whether or not the new maps are to be engraved on one of them for general use.

In my former letter I stated, that "the six-inch scale has been found in Ireland large enough for the expression of all geological detail," but that an engraved twelve-inch map for Scotland and the North of England would be "equally applicable and convenient." Subsequent experience has induced me to modify this opinion. I have now had an opportunity of using the six-inch scale in Scotland, and found it everything that could be desired for geological purposes; and though, if a twelve-inch scale be engraved, it may be applicable for geological mapping, I am now aware that it will be so cumbrous to use in the field, that the expression of geological detail on such a map will be

H h

Replies in favour
of the 24-inches
and ten-feet scales.

exceedingly difficult and tedious, and when completed less clear and useful than if a larger area can be viewed at once, as is the case with the geologically-coloured six-inch maps. If one of the larger scales be ultimately adopted for engraving, (say twenty-four inches to a mile,) it seems to me that it would be impracticable to use it on the Geological Survey in the field, since each surveyor would require to carry with him for his daily work probably not less than from fifty to a hundred large sheets of map.

(Signed) ANDREW C. RAMSAY.

No. 24.

MR. J. F. BATEMAN, CIVIL ENGINEER.

Manchester, February 14, 1854.

Of the three scales submitted for consideration, I should prefer the first: viz., 24 inches to the mile for rural, and 10 feet to the mile for town districts, although there would be no practical inconvenience in using the decimal scales referred to under the third head.

I may, perhaps, be permitted to say, that I am strongly of opinion that all the scales are much too large for ordinary engineering purposes, as well as for public purposes and reference generally.

No. 25.

MR. ROBERT RODWELL, LAND SURVEYOR.

Bury St. Edmunds, February 16, 1854.

I am requested by my father, in reply to your letter of January 28th, to state for the information of the Lords Commissioners of Her Majesty's Treasury, that he considers a scale of 24 inches to the mile for rural, and of 10 feet to the mile for town districts, will be best adapted to comprehend the objects for which surveys and plans are usually made.

No. 26.

MR. JAMES JOHNSTONE, M.P.

10, Wilton Place, February 16, 1854.

From the best advice which I have been able to obtain, I am induced to recommend the scale No. 1; viz., 24 inches to the mile for rural districts, and 10 feet to the mile for town districts. I am not, however, aware that the adoption of the decimal scale would be productive of any practical inconvenience.

No. 27.

HIGHLAND AND AGRICULTURAL SOCIETY.

Edinburgh, 6, Albyn Place, Feb. 16, 1854.

I am instructed by the directors of the Highland and Agricultural Society to inform you that, having carefully considered the different scales for the Ordnance Survey, proposed in your letter of January 16, they prefer the first therein mentioned, viz.: a scale of 24 inches to the mile for rural, and of 10 feet to the mile for town districts.

With regard to the other scales that have been submitted, the directors consider the second, that of three chains to the inch, nearly as suitable as the first for rural districts; but they would deprecate the adoption of the third, either for town or country.

Replies in favour
of the 24-inches
and ten-feet scales.

(Signed) J. HALL MAXWELL.

No. 28.

MR. G. S. DUFF, M.P.

11, South Audley Street, Feb. 20, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th ult., requesting me to inform the Lords Commissioners of Her Majesty's Treasury which of the scales therein mentioned I should recommend for the adoption of the Ordnance Survey, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made. And I beg to state that, in so far as I have been able to form an opinion on the subject, I should be inclined to recommend the adoption of the first scale mentioned in your circular, which appears to me to be calculated to meet the proposition which is now made.

No. 29.

LIEUTENANT-COLONEL HUNTER BLAIR, M.P.

House of Commons, Feb. 16, 1854.

I beg to acknowledge the receipt of your communication of January 16, in reference to the scales of survey for Scotland, and I think a scale of 24 inches to the mile for rural districts, and 120 inches to the mile for the towns, would be the most advantageous of the three scales which are proposed by the Treasury.

No. 30.

MR. JAMES DUFF, M.P.

41, Eaton Place, February 20, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th ultimo, requesting me to inform the Lords Commissioners of Her Majesty's Treasury which of the scales therein mentioned I should recommend for the adoption of the Ordnance Survey, and I beg to state that I am inclined to recommend the adoption of the first scale mentioned in your circular.

No. 31.

MR. JAMES F. BEATTIE, LAND SURVEYOR, &c.

Aberdeen, February 20, 1854.

I duly received your communication of the 16th ultimo.

I beg to say that I would recommend the scale of 24 inches (2 feet) to the mile for the rural, and 10 feet to the mile for the town districts, in preference to either of the others proposed.

The scale for the rural districts being one-fifth of that for the towns, without fractional parts, as in the second case.

H h 2

Replies in favour
of the 24 inches
and ten-feet scales.

There would be great practical inconvenience in the scales of $\frac{1}{2500} = 2$ feet $1\frac{1}{3}$, and $\frac{1}{500} = 10$ feet $6\frac{2}{3}$ inches to the mile.

The scale of two feet per mile of 5,280 feet is equal to $3\frac{1}{3}$ imperial chains per inch, or 220 feet. This is probably as equal a fraction as need be looked for under the system of measures at present existing.

A scale of $3\frac{1}{3}$ chains to an inch is amply large for rural districts; $3\frac{1}{3}$ chains to an inch, or $\frac{1}{12}$ th of a foot, is equal to 4 chains to $\frac{1}{10}$ th of a foot. Should ever decimals of a foot be adopted, and the chain retained as at present, this would give 400 links to the tenth of a foot.

I have no doubt you will receive a diversity of opinion on this subject. It would have been of great importance in a work of such magnitude and utility, could we have had the scales of feet and the scales of chains (or 100 links) to bear some proportional decimal of one another.

No. 32.

MR. GEORGE DUNDAS, M.P.

26, Pall Mall, February 22, 1854.

I have to apologise for not having earlier replied to your communication on the subject of the Ordnance Survey, but the necessity of my having been obliged to correspond with those in the county of Linlithgow, interested in the question, will I trust be accepted as an excuse.

The scale which I would venture to recommend, and which would, I am certain, be most acceptable in the country, is the scale No. 1., that of twenty-four inches to the mile for rural, and of ten feet to the mile for town districts.

The third mode has no doubt the advantage of being capable of transference into the measures of the Continent; but then, every man who used it would require to construct a scale for himself, or at least to set about a calculation for which practical men, such as farmers, are seldom qualified. This plan would, therefore, it appears to me be subject to practical inconvenience, from which the simplicity of the first form is exempted.

No. 33.

MR. JOHN R. HASLAM, LAND SURVEYOR, &c.

Menai Bridge, February 22, 1854.

Having had many years' practice in surveying estates, both in rural and in town districts, I have invariably adopted the scale of $26\frac{2}{3}$ inches to the mile for the former, and 40 feet to the inch for the latter: these scales were adopted because the minor subdivisions were the most suitable and easy to be obtained at the mathematical instrument makers. But at the same time, I beg it may be clearly understood, that I have lost much time, and been often inconvenienced by the odd parts in the larger divisions. For instance, in preparing contract surveys and plans for railways on three chains to one inch, or $26\frac{2}{3}$ inches to the mile. This scale is most troublesome. The standing orders of the House Commons require the adoption of miles and furlongs.

In my own practice $26\frac{2}{3}$ inches to the mile has been used for reasons stated, and also as being ample for all kinds of rural surveys; but most of my contemporaries have adopted and still use a smaller scale, viz., 20 inches to the mile, which is certainly much more convenient when the larger divisions are used.

The minor sub-divisions of this scale, I have always maintained, are too fine to allow of rural surveys being laid down with a proper degree of accuracy. It will be observed that the 20 inches to the mile is too small, and the $26\frac{2}{3}$ rather large, and most inconvenient for more extensive operations. Replies in favour of the 24 inches and ten-feet scales.

I therefore feel much pleasure in being honoured with an opportunity of stating to your Lordships, that the minor sub-divisions of a scale of 24 inches to the mile would be sufficiently large to comprehend with accuracy all objects for which rural surveys are made; and, without causing the slightest inconvenience to any party, would at the same time add most materially to the convenience of those surveyors who may be engaged upon more extensive operations.

Having invariably used and recommended the scale of 40 feet to the inch, or 11 feet to the mile for town districts, because the minor sub-divisions were convenient, I need scarcely trouble your Lordships by observing that the smaller subdivisions of 10 feet to the mile will be perfectly suitable, while the larger will be far superior. I therefore beg permission to add, that the first set of scales named in your Lordships' circular will not only be the most convenient for practice, but certainly the most worthy of being adopted as national scales, for they would soon become so by choice and utility.

Having, I trust, fully explained to your Lordships my opinion from practice as to the proper scales to be adopted for rural and town district surveys, I now take the liberty of making a few observations on the scales recommended by the Statistical Society. This I cannot do from ever having used the scale of $\frac{1}{2500}$ and $\frac{1}{500}$; but it appears to me that so long as our standard yard is 36 inches, and our standard foot 12 inches, our chain 66 feet, and our mile 80 chains, it is necessary first to ensure a proper degree of accuracy by attending to the minute sub-divisions, and at the same time not to lose sight of the advantage of ensuring convenience and despatch by adopting those larger divisions which are composed of whole numbers,—for instance, two feet to the mile; one foot half a mile;* three inches one furlong, or ten chains. By such an arrangement there would be no decimals or fractions, and nothing to confuse. On the other hand, the scale said to be one “bearing a definite numerical proportion to the linear measurement,” would be open to greater objections in practice than the scale of $26\frac{2}{3}$ inches to one mile, because $\frac{1}{2500}$ is 24 inches $\frac{112}{10000}$ parts to one mile for rural districts, and $\frac{1}{500}$ would be 10 inches $\frac{56}{1000}$ parts for town districts.

These scales, in my opinion, would cause a sort of revolution in surveying extensive districts for content.

With reference to the Brussels scales, I beg permission to refer your Lordships to the difference in the lengths of the Continental measures. In Brussels the length of the foot compared with the English standard is 11 inches 24 parts. The Brussels mile of 2 feet $1\frac{1}{3}$ would make two English feet within the decimal of $\frac{20}{100}$.

No. 34.

MR. GEORGE HEWETT, LAND SURVEYOR, &c.

Oxford, February 25, 1854, (late of Elvetham, Hants.)

In reply to your Lordships' circular letter of the 16th ultimo, on the subject of the Ordnance Survey, requesting me to state which of the scales enumerated in such circular letter I would recommend, supposing it to be determined that the scales shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made; and also requesting an opinion as to whether the adoption of the decimal scales recommended by the Statistical Society of London and the Statistical Conference at Brussels would be productive of any practical inconvenience, I have the honour to recommend the adoption of the scales first so enumerated, viz., a scale of twenty-four inches to the mile for rural, and ten feet to the mile for town districts.

* A convenient length for plotting Scales.

Replies in favour
of the 24-inches
and ten-feet scales.

With regard to the scales recommended by the Statistical Society of London and the Statistical Conference at Brussels, namely, $\frac{1}{2500}$ for rural, and $\frac{1}{500}$ for town districts, notwithstanding the high authorities quoted, I cannot but think that considerable practical inconvenience would result from discarding from the scales to be used all reference to the foot and inch measures.

No. 35.

MESSRS. THOMAS and GEORGE CHAPMAN, LAND AGENTS
AND SURVEYORS.

23, New Street, Spring Gardens, February 25, 1854.

Having very carefully perused the mass of valuable information you have done us the honour to submit to our inspection, we fear we can scarcely add to it, but being desired, are ready to offer an opinion to your notice, so far as affects our own profession, and beg to

Recommend,

	Inches to the Mile.
For the Draft Plans of Rural Districts to be preserved as public records - - - - -	24
For the Plans to be engraved for sale - - - - -	8 and 1½
For the Draft Plans of Towns for record - - - - -	120
For Plans of Towns to be engraved for sale - - - - -	12

Special Observations.

The 24 inch scale appears to have the approbation (*see* page 31) of the Board of Health, and Colonel Dawson's experience, no slight recommendation; and though 24 inches to the mile is not a scale in common use, it is sufficiently large for a correct survey (three or four chains to the inch being at present the most usual); and since the whole work is to be done by and retained in one office, so that it is large enough for accuracy, it matters little that an unusual scale be adopted, since any copies required by landowners or engineers would go through surveyors' hands, who, being comparatively a small community and used to the business, could and would easily adopt the scale without inconvenience. And as regards the general public, who *would* be inconvenienced by new fractional scales, the plans proposed to be engraved for sale would be adapted to scales universally diffused throughout the kingdom.

As to the plans to be engraved for the use of the public at large, eight inches to the mile, a multiple of the above, and being *ten chains* to the inch, is a scale sufficiently large for all general estate, parochial, and district valuations and schedules, and far more convenient for most purposes than larger plans, seeing how clearly all the lines are set forth by engraving; for if at 12 inches, or even double this size, no surveyor would use those maps for ascertaining contents or areas, but would resort to the original maps. This eight inch scale is also a multiple of that generally used by engineers, viz., the 5 chains to the inch.

These maps should consist of plain lines, with all details as on the Irish six inch maps (most beautiful productions), with elevations of the land in figures, not however always in a series of direct lines, as there shown, but scattered as the elevations gradually increase from the lower grounds; and a series should extend up all principal valley bottoms for the use of drainage, sanitary, engineering, and other purposes. And also (let us plead on behalf of a large class of Her Majesty's subjects who neither ride nor drive, and to whom the saving of half a mile is of consequence when plodding to and fro to daily labour), with the addition of well accustomed *footpaths*, the use and the enjoyment of which the poor pedestrian is often diverted from and finally deprived

of, from the almost total neglect of any general public record of his rights. In hilly countries, also, the footpaths are often of more general use than cartways, and quite as much a feature of the country.

Replies in favour
of the 24-inches
and ten-feet scales.

The smaller, or topographical map would be the one in most general demand, and however beautiful and accurate the present one inch Ordnance maps may be, yet they are scarcely large enough for the great quantity of matter comprising English topography. Enlarged to one inch and a half, which is a multiple ($\frac{1}{18}$) part of the 24 inch scale, we conceive they would be found more useful and attractive than the one inch maps, and give a sufficient scope of country at one view to suit the requirements of laying down the outlines of any great work, and with more accuracy of design. This map should have the configuration of the ground shaded, with the heights only of distinguished spots, and it would only require the division of uncultivated and cultivated lands, without any subdivision of the latter. This scale represents the "three barley corns," if that is any recommendation. Two inches would be preferable to one, but it is somewhat too large.

The town map scales are also multiples of the 24 inch scale.

No. 36.

PRESIDENT OF THE GEOLOGICAL SOCIETY.

Geological Society, February 27, 1854.

In answer to your communication of the 16th ult., respecting the proper scales for Ordnance maps, contained in the circular letter of the Lords Commissioners of Her Majesty's Treasury, I beg leave to say, that so far as scientific purposes are concerned, the distinctions between the three scales are immaterial.

They are all too large for convenient use as scales for working geological maps. At the same time, minute details of soils can best be noted upon maps of large scale, and cannot be shown so as to be agriculturally useful on a scale much under twelve inches to a mile. For mining plans, the scales mentioned in your letter might prove serviceable.

(Signed) EDWARD FORBES.

No. 37.

PROFESSOR SMYTH, F.R.S., L. & E.

Royal Observatory, Edinburgh, February 27, 1854.

In attempting at length to answer your letter, doing me the honour of asking my opinion on the three proposed scales of the Ordnance Survey, I can at least speak now from long and full consideration of the subject, viz., the respective merits of scales.

- 1st. 24 inches to a mile for rural, and 10 feet to a mile for town districts.
- 2d. Three chains, or $26\frac{2}{3}$ inches to a mile for rural, and 10 feet for town districts; and
- 3d. $\frac{1}{2500}$ for rural, and $\frac{1}{500}$ for town districts.

The last of the three appears to be a very neat and compendious method, and has not a little appearance of scientific pretensions, but a slight examination will prove these qualities to be possessed but in appearance; that the scheme aims at what has been found to be unattainable in practice, even by the most admirable of trigonometrical operations; and further, that it is precisely the course which has been eschewed by the British Government, and emphatically pronounced against on various occasions by its learned and able Commissioners on the system of standard weights and measures of the country, during the last fifty years.

To demonstrate these weighty objections, let us first clearly ascertain what these proposed $\frac{1}{2500}$ and $\frac{1}{500}$ actually are. They have been called *decimal* scales

Replies in favour
of the 24-inches
and ten-feet scales.

and at a time when efforts are being so worthily made to decimalize our weights, measures, and monies, such a name will at once excite favour. But they are *not* decimal scales, $\frac{1}{10}$, or $\frac{1}{100}$, or $\frac{1}{1000}$ would be; but $\frac{1}{2500}$ and $\frac{1}{5000}$ are vulgar fractions, and can merely be called parts of a *natural* scale, viz., $\frac{1}{2500}$ and $\frac{1}{5000}$ of the real length of the surface of the ground in nature; and as parts of a natural scale let them be discussed.

Now can such a natural scale ever be exactly secured? Will the maps be what they profess to be?

To answer this, we have fortunately the experience of nations to refer to. At the close of the last century the French, the most scientifically inclined of all nations, attempted to found their admirable decimal system of weights and measures upon a term of a natural scale. This term was to be the $\frac{1}{10,000,000}$ of the earth's quadrant, and to be called a metre. Their first men were engaged many years in extensive operations to determine this length; the savans of all Europe were invited to assist at the calculations to insure them from error, and at length a brass bar, the standard metre, was produced as the $\frac{1}{10,000,000}$ part of the earth's quadrant. The English nation has however wisely stood aloof from this grand exhibition of practical experience, and, firmly believing that it would only end in the legalizing and perpetuating of error, established a more successful natural reference for their standard scale. They took a good stout bar of metal (of what length did not matter much, but for convenience, the standard yard), and proceeded to determine the length of that in terms of a natural standard,—making sure that the length of the bar, as easily obtainable by them, was much more trustworthy than the result of their necessarily operose determination of that of the natural standard, so likely was that to be modified by the increased knowledge of posterity of all the circumstances likely to affect the inquiry. Posterity might demonstrate our determination of the natural scale to be wrong, but they could not invalidate our measured length of the bar of metal; therefore, on that bar of metal, as the more unalterable to us, our weights and measures were founded, care being taken to publish, in the event of its ever being lost, and before better comparisons could be made, the length of such bar in terms of some natural measure which could *not* be lost, according to the best means of the existing age.

And what has been the result of these two methods of proceeding? Why, within the last few years, the French have found, in spite of their extraordinary precautions, a very large error was made in part of their survey to ascertain the length of $\frac{1}{10,000,000}$ part of the earth's quadrant, so great as to tell very sensibly on the length of their brass bar, the standard metre. In fact, their standard metre is not the metre that it was to have been, but a very ugly fraction indeed of the earth's quadrant, and to be made uglier still, probably, by future researches. Here is a calamity to have arrived at; after upsetting for a time all the manners and customs and dealings of the nation, to gain a theoretically perfect system of measures, the radical unit is a certain metal bar in Paris, and the absolute value of those measures can only be ascertained by a numerical statement of the indefinite fractional proportion which the metal bar bears to some natural unit.

The English, then, having found the French plan in so few years to result in theirs, are justified in adhering to it, as testified lately in the Report of the Parliamentary Commission on the Standard Scale; and again, only last summer, in the formation of metal bars as standard scales, and in the burying of some of those bars deep in the masonry of the new Palace at Westminster, convinced that those bars will hand down to future times a truer idea of the length of our measures than any calculated proportion of its comparison with an arc of the meridian, or the seconds pendulum, though that is added too, as a forlorn and imperfect hope, in case of utter destruction by fire or earthquake; but no use will ever be made of it as long as the bars themselves exist.

Thus, then, it appears from the grandest of scientific operations ever conducted by two of the most advanced of all nations, that a *natural* scale can never be exactly ascertained and positively ensured, and that the very notion of attempting it has been repudiated by this country more than once. And if it was impossible to attain this point with the standard scales, on which such superfluity of human skill was lavished, regardless of expense, how much

less likely is it to be reached in maps which must be brought out quickly and cheaply? They may be stamped and sworn to by the Government as $\frac{1}{2500}$ and $\frac{1}{2500}$, but they will invariably be found to be some other fraction; nay, from the variable rates of expansion and contraction of different papers, every map will be of a different proportion, as $\frac{1}{2534}$ or $\frac{1}{2549}$, &c. &c.

But I hasten on to the question in your Lordships' letter, "As to whether these (natural) scales will be productive of any practical inconvenience?"

I fear that the question is rather, whether they will be usable by the great body of the people? For how does the mass of men judge of distances and lengths, such as appear on sheets of paper? Why, invariably in feet, and inches, and in parts of an inch. Engineers, surveyors, mechanics of every grade and occupation, as well as professional men, are ever accustomed to measure and estimate the size of small things in inches. What is the thickness of that plank, or that iron rod; or what is the distance between those points on that piece of paper? Oh, says the practical man at once, right off the reel, "One inch and a half;" and if he wants it very exactly, he is sure to have a ruler in his pocket, divided to inches, wherewith to measure the space more accurately; nay, so deep set is this method of measuring distances in the English practical mind, that it is, in default of better, applied to things when it is not proper, as in estimating the size of a planet in the field of a telescope. And yet it has been curious to observe how very close a number of carpenters came to each other, in the inch dimension which they attributed to Jupiter, on one such occasion within my knowledge. It showed, however, what a strong tendency to, and extreme facility for, determining small spaces in this way, the simplest of working men have. They *will* speak of space, and measure it, in inches, and can do so very correctly; and if, in the case of their (above) inch and a half space on a map, they are told that that map is on a scale of six inches to a mile, at once they have the meaning of the paper, and know that the distance in question is $\frac{1}{4}$ of a mile. But show them, show any one, high or low, theoretic or practical, two points on a map of a scale of $\frac{1}{2500}$, and demand an off-hand answer of the distance of those two points on the earth's surface in feet or yards or miles, and none of them will be able to answer with any sort of correctness. It is not to be done, for the mind has not the power of multiplying the little space on the paper by such a large number as 2500 (or it would be 2534, or 2549, or something of that sort, exactly), and then imagining how much that would make on the surface of the ground. The large number would have to be cut down to several smaller ones, and the best practical plan would be found to throw overboard the nominal natural scale as such, retaining only an idea of how many inches, about, to a mile it was equal to, and then estimating the space on the paper in inches,—in fact, coming back again to the old plan.

This method, therefore, of the natural scales will not only be inconvenient, it will be inoperative; it will be a stumblingblock to all practical men. It is merely a hobby of a few closet gentlemen, and is a specimen of the fatal way in which as soon as a new idea with some good in it has been struck out, it is straightway pushed to extremes. I have the less hesitation in speaking out on this matter, having seen in a late scientific work some very undue reproof administered to Government, because they would not overlook all the thousand and one practical advantages of the existing scales, and adopt the natural one which the author proposed. He proudly referred to little maps in his own book as being on a natural scale, $\frac{1}{2500}$. I think, but before the mass of his readers could make out the real size of the districts represented, they had to deduce the nearest and roundest parts of an inch to a mile, that the above natural fraction was equal to. For accurate purposes, however, neither this plan, nor yet the long arithmetical process of multiplying measured paper lengths by 60,000 would answer, by reason of the anomalous expansions and contractions of the paper in printing. These can be only guarded against by engraving the scale on the plate, and printing it with the map to expand and contract on the same paper. Had this been done, and the scale of one inch to one mile been chosen, (mention being made, if any were so ignorant as not to know it already, that such scale was equal to the $\frac{1}{2534}$ of nature), the said maps would have been of far more use, of much readier reference, and of infinitely more accuracy in extreme cases.

Replies in favour
of the 24-inches
and ten-feet scales.

Had the Government unfortunately listened to the doubtless well-meaning, but very crochetty advice offered to them, their Ordnance maps would have become isolated by their unpractical character. The steady-going Englishman would not be disturbed in all his natural, or at least long accustomed, modes of measuring distances, and in place of the Government maps being used, private geographers would have had the task, lucrative to them but ruinous to the nation, of translating the Ordnance sheet into a scale which was suitable to, and readable by the people.

I cannot, then, but think the now proposed plan of having the Ordnance Survey published on a natural scale,

As impossible to be obtained to the numerical exactness stated :

As opposed to the principles and practice of the British Government, in its present and past views and proceedings with reference to the standard measures of the country,

And as extremely inexpedient on account of the excessive inconvenience and disturbance which it would occasion to the great mass of practical men in this country in their ordinary every day modes of estimating and dealing with lengths and spaces.

Assuming the principles by which these results have been obtained to be correct, there will be little difficulty in deciding on the merits and failings of the first and second scales proposed by your Lordships.

Having shown the inexpediency of the third proposition, or the *natural* scale, on general principles, I have now to consider the first and the second.

But the second may be quickly disposed of, for if the principle be adhered to, viz., that the scale of the Ordnance maps be in terms and measurements generally understood and universally used by the great body of the people, then a scheme that sacrifices feet and inches to preserve an equality in *chains*, is not to be allowed. For the people at large know nothing about chains; it is a measure belonging to the land surveyors alone, it is a part of their shop, one of the peculiar crafts of the trade; and if they do find some practical advantages in using such a measure in certain parts of their operations, it should be looked on only as a means to an end; and that having been secured, the result should be published in the language of the mass of the people, viz., feet and inches.

And this is invariably done at present in private surveys of the most *valuable* ground, viz., that in large cities; for it is bought and sold by the foot and the inch: and as land increases in value throughout the country the chain will become more and more obsolete, and only be known in unimproved rural districts.

We are thus forced back on the first proposition, viz., 24 inches to one mile for the country, and 10 feet to one mile for the towns. Now here is a scheme, according to all we have said already, agreeable to the spirit of the nation, and suitable to its customary measures and manners; it deals only in feet and inches, which every one understands, every one uses, and every one has already actual accurate scales divided to that length.

It is, moreover, an even multiple of the already existing one inch and six inch maps—a most precious feature; for how often will the proposed new maps have to be compared with the old, and how easy is it to reduce; to multiply one or divide the other by two, three, or four. Every one can do this with a common pair of compasses; but it requires a very peculiar one to compare the six inch with the $26\frac{2}{3}$ or $25\frac{1}{3}$, which would form the problems to be daily solved in case of either the second or third proposed scales being employed.

Of course in practice, to guard against contractions and expansions of the paper, and supposing the first plan to be adopted, the nominal 24 inches would be engraved on each plate and printed on each sheet. In this case, to satisfy those gentlemen who are so anxious for the adoption in these maps of a natural scale, there may be printed at the same time a notice that the proportion of 24 inches to one mile is a natural scale of $\frac{1}{2640}$. Doubtless this would be a truism, or a truth so well and generally known that it need not be repeated; but that the croakers should have borne in mind, when abusing the Government before, for not giving out their maps on a natural scale. Why, they were: and the number of inches or parts of an inch to a mile (which was always carefully published) tells the fact at once to every Englishman.

A Frenchman or a Russian might not perhaps see it so immediately, though he would soon find it out; and he might not be so *au fait* at using our maps of so many aliquot inches to a mile, as Englishmen; and this because *his* inches or decimetres or national small measures are radically different to ours. His trouble would not be that our maps on the scale of $\frac{1}{2640}$, were not quite so round a fraction of the natural scale as the $\frac{1}{2500}$, but rather that they were not in aliquot terms of his usual measures, which might come out $\frac{1}{2350}$ or something quite as rough as ours.

Replies in favour
of the 24-inches
and ten-foot scales

Owing to this, the foreigner could not use our maps as quickly as we could ourselves; and I do not see that this is a disadvantage to us. For to what purpose would a foreigner want to use such detailed maps as those of 24 inches to a mile? It was thought in the last war that Napoleon Bonaparte wanted the Ordnance plans for the purposes of invasion, and therefore the publication of them was stopped for a time. Now what is the demerit of a difference of a scale, which, while it was the most serviceable possible to ourselves should be continually puzzling and boggling invading generals, and compelling them to operose calculations whenever they wanted accuracy. In the great and perilous game of war, where everything depends not only on choosing the *right* course, but choosing it quickly, the convenience and practicability of a scale might tell immensely.

While war thus counsels us to adopt a national scale, adapted to ourselves and uneasy for others, peace does not indicate otherwise. For we are not like many a German state, merely a component part of one large country and community, separated by no natural obstacles, and with roads, and villages, and towns, speaking the same language, and gradually inosculating from state to state. We on the contrary are absolutely isolated in position, in language, in climate, in manners, and customs, and occupations. We are a nation *totus terres atque rotundus*. Greenwich time is the time for all our country, and it matters not what time is used in Paris or Vienna. Our railways are of a certain guage, and it matters not whether different from the continental ones, for our locomotives do not reach them.

For what purpose then need we have our maps made inconvenient to ourselves, in order to be of the same size as those of some nation on the Continent? No good one that I know of. The case where a uniformity in the size of maps of different countries is desirable, is in cases far different to that now under discussion. It is well enough for instance in a school atlas, where maps of all the countries on the face of the earth are bound up between two boards; for then the school boy will understand, as he turns over the pages, that Belgium is not as large as Austria, nor Ceylon as extensive as the East India Company's possessions—though in other atlases each of the above territories may be represented on sheets of equal size.

But never for the purpose of instructing learners will the Government Survey of this country be bound up with the surveys of other countries in one book. As soon will the ocean be taken up and put into a bucket, and our green fields join bodily on to those of Holland, and France and Spain. There will be thousands and tens of thousands of sheets of our own country, making a whole library of ponderous folio volumes all by themselves, and myriads of men will never have to employ themselves out of their range.

Should one solitary man wish now and then to extend his researches from one country to another, he can no more complain that the scales on the English maps are adapted to English measures, than that the names thereon are in the English language rather than in that of some other people.

Here is another opportunity of profiting by the experience of nations on a great scale; for the establishment of an abstract term of a natural scale, as $\frac{1}{2500}$ for the maps of all nations, in defiance of their individual measures of length,—is exactly similar to the calamitous experiment persevered in so long during the middle ages, of having the religion and the learning of all nations expressed only in one common language, the Latin. So Latin was the only medium of the churches and schools of those days.

What was the result? The world remained in darkness, and learning ceased to progress. The mass of the people had no knowledge of the uncouth language, and even the educated few could never wield it as effectively as their own mother tongue. So it was found necessary at last to give the college lectures in Germany in German, and in England in English; everywhere in

Replies in favour
of the 24-inches
and ten-feet scales.

the native language. Instantly science advanced, for everyone in the whole body of the nation could enter into it, and at once apply it to their daily experiences. But for this most salutary reform we might still have been in darkness, and our country would certainly have been without the glory and the advantage which its many mechanical and scientific geniuses, arising out of the poorest classes, have so abundantly shed upon it.

By no means then let the Government give way to a Utopian crochet of a few scientific Normans, but rather consider the practical requirements of the great Saxon bulk of the nation. With this view they can hardly fail to prefer the first of the three schemes proposed in your Lordship's letter, viz., 24 inches to a mile, or $\frac{1}{2640}$, for the country, and 10 feet to a mile, or $\frac{1}{528}$, for towns.

I can hardly conclude without saying how gladly I would hail a decimalization of our weights and measures, but I cannot regard the scale of the Ordnance maps as the right place whereat to introduce the small end of the wedge.

No. 38.

MR. HENRY LAKIN, LAND SURVEYOR, &C.

Worcester, February 28, 1854.

I have to acknowledge the receipt of your communication in reference to the scale of maps for the Ordnance Survey, and in reply I beg to say that I consider the scale No. 1 is very suitable for the Ordnance Survey, and much more so than No. 2. I think No. 3 is also suitable, but being a novel scale in the hands of surveyors generally, would (until persons had become accustomed to it) be objectionable, but eventually I believe it would be well appreciated.

No. 39.

THE EARL OF ROSEBERY.

Piccadilly, March 6, 1854.

In reference to your letter of January 16th, I beg now to communicate the result of my inquiries of those most competent to form a correct opinion on the subject of it in the county of Linlithgow. This is, that a scale of 24 inches to the mile for rural districts is the best; which I understand is also the opinion expressed by the Highland and Agricultural Society of Scotland.

R E P L I E S

IN FAVOUR OF

The $26\frac{2}{3}$ Inches and Ten Feet Scales.

Replies in favour
of the $26\frac{2}{3}$ -inches
and ten-feet scales.

No. 1.

MR CHARLES NEALE, LAND AGENT AND VALUER.

Mansfield Woodhouse, Mansfield,
January 17, 1854

I have the honour to receive your letter of yesterday's date, and lose no time in giving my opinion as requested.

In my former communication, I recommended the proposed scale, No. 2, on the ground that the Tithe Commutation surveys and plans would be available in the preparation of the proposed survey, and the maps now in existence would continue of the same use as before; and as the Tithe Commutation is a permanent arrangement, it is doubtful whether any other scale could be adopted so generally useful in rural districts, and I am therefore strongly inclined to adhere to it.

I do not think the adoption of the proposed decimal scales would be productive of much practical inconvenience after the public had become familiar with them, and particularly as almost every person who can survey a field can compute the content thereof in decimals.

No. 2.

MR. E. W. WILMOT, LAND AGENT AND VALUER.

Hulme Walfield, Congleton,
January 18, 1854.

In answer to yours of the 16th January, enumerating three scales for maps, I beg to say that, in my opinion, the scale No. 2, would be the most useful, and generally desired.

The scale No. 3 would be in some cases useful, but for general purposes would not be fully appreciated.

No. 3.

MR. B. BADCOCK, LAND SURVEYOR, &c.

Oxford, January 20, 1854.

In reply to your Lordship's letter of the 16th instant, I beg to say that, of the three classes of scales proposed for the Ordnance Maps, I should recommend the second, viz., a scale of three chains to the inch, or $26\frac{2}{3}$ inches to the mile for rural, and of ten feet for town districts.

I think four-fifths, at least, of the original plans of rural districts are three chains to the inch. I believe the adoption of the decimal scales would be productive of much practical inconvenience at first.

Replies in favour
of the $26\frac{3}{4}$ -inches
and ten feet scales.

No. 4.

MESSRS. PICKERING AND SMITH, LAND VALUERS, &c.

14 Whitehall Place, January 20, 1854.

In accordance with the request contained in your letter of the 16th instant, we have considered which of the three scales therein mentioned we should recommend, supposing the scale to be intended to be sufficiently large to comprehend all the objects for which surveys and plans are usually made; and we are of opinion that, of *these three* scales, we should recommend the scale of three chains to an inch.

We think that the adoption of any scale in which the inch does not give a multiple of a chain would be highly objectionable; and that the scale suggested of $\frac{1}{2500}$, not having inches and chains at any point coterminous, is most objectionable and inconvenient. A decimal notation should facilitate calculation; this scale would have a contrary effect.

A perusal and consideration of the "replies" to the previous circular of the Lords Commissioners, confirms us in our expressed opinion in favour of the scale of 20 inches to the mile: a scale combining in itself all the advantages advocated as belonging to the three scales mentioned in the present circular.

It is a scale on which each inch delineates $\cdot 05$ of a mile, two inches $\cdot 1$, five inches one quarter or $\cdot 25$ of a mile; and by which consequently long measure and square measure are placed in the simplest relation to each other.

It is a scale on which measurements can be plotted and areas calculated with the utmost precision; and as such the Tithe Commissioners, reporting that "maps on a *smaller* scale than four chains do not admit of being accurately "tested as to quantities," sealed maps upon the four chain, as well as maps upon the three chain scale.

It is *the* scale on which estate plans have for very many years been generally made, both in England and in Scotland; as instanced by the Duke of Devonshire, plans on that scale are most highly esteemed, and large estate plans are at the present moment made upon this scale.

The scale for towns of 10 feet to a mile will be a multiple of the four chain scale, which it would not be of the three-chain scale; and mineral surveys, which are upon the two-chain scale, will also bear an easily understood proportion to the general survey on the four-chain scale.

The map resulting from the adoption of this scale will be little more than half the size of one upon the three chain (as 9 to 16), and will nevertheless give the smallest details clearly and distinctly.

No. 5.

MR. JOHN DICKSON, LAND AGENT, &c.

Saughton Mains, Edinburgh,
January 20, 1854.

I beg to acknowledge the receipt of your favour of the 16th instant, and in reply beg to state that I would recommend the second mentioned scale, viz., three chains to the inch for rural districts and ten feet for towns; my reason for doing so being that these scales are already in general use with surveyors, and therefore with reference to existing plans might be more convenient than the others.

No. 6.

MESSRS. HYDE AND Co., LAND SURVEYORS, &c.

24 Guildford Street, Russell Square,
January 23, 1854.

In reply to your communication of the 16th instant, we beg to state that we should recommend the three-chain scale for rural and the ten-feet scale for town districts.

But we are strongly in favour of the system recommended by the Statistical Society on account of its *universality*, and we do not see the least practical inconvenience attending the adoption of the decimal scales.

No. 7.

MR. CHARLES HIDE, LAND SURVEYOR, &c.

Replies in favour
of the 26 $\frac{2}{3}$ inches
and ten-feet scales.

Worthing, January 23, 1854.

Offices, High Street.

I beg to acknowledge the receipt of your letter of the 16th instant on the subject of the Ordnance Survey, requesting me to inform your Lordships which scale therein named by you I would recommend to be used, on the supposition of your Lordships having determined that the scale shall be sufficiently large to comprehend and embrace all the objects for which surveys and plans are usually made. In reply thereto, I would beg to notice each scale separately as they stand, viz.,

1. A scale of twenty-four inches to the mile for rural, and of ten feet to the mile for town districts.

The twenty-four inch scale per mile is doubtless sufficiently large clearly to represent all the rural districts, being only $2\frac{2}{3}$ inches per mile less than that hitherto adopted by the Tithe Commissioners for their first-class maps, from which also quantities have been accurately computed. The ten feet scale is ample for town districts.

These scales have a certain advantage, inasmuch as they bear a definite numerical proportion to each other; also from their being the scales now so extensively used under the General Board of Health in laying down the plans for sanatory works throughout the kingdom.

2. A scale of three chains to the inch, or $26\frac{2}{3}$ inches to the mile for rural, and ten feet for town districts.

The three chains to the inch, or the $26\frac{2}{3}$ inches to the mile scale, has certain advantages, as also it has certain disadvantages, to the one before-named; its advantages, in that of being slightly larger and clearer in laying down the rural districts, and to my mind, also the great consideration of being the same as that already used by the Tithe Commissioners, with whose maps it would be in unison, and consequently have reference to, should such be needed, while with the ten-feet scale for the town districts it would assimilate with, and be in unison with the prescribed scale for the detailed sheet maps of towns under the General Board of Health, so that the two scales would be those adopted by those two great Commissions as well as the Ordnance. Its disadvantages appear to me principally to consist in increasing the size of the maps in so extensive a survey (the cost being only that of the increase for stationery) and of there being no definite numerical proportion between the two scales.

3. Scales bearing a definite numerical proportion to the lineal measurement of the ground to be mapped, i.e. the scale of $\frac{1}{2500}$ for rural, and $\frac{1}{500}$ for town districts, as recommended by the Statistical Society of London, &c. &c.

There can be no doubt but that the numerical proportion between two scales proposed to be used under one work would be very desirable, particularly if no existing works had to be considered, as just proportion is at all times pleasing; but, in my own mind, if anything substantially good could be obtained by the abandoning it, I should be disposed to do so. I have a favourable opinion of the first named scale of 24 inches to the mile for the rural districts, and 10 feet per mile for the town districts, these being the scales adopted by the General Board of Health; but I confess, nevertheless, I think that the three chains to the inch, or $26\frac{2}{3}$ -inches to the mile scale of the Tithe Commissioners, and the 10-feet scale for the town districts, would, upon the whole, be the best, as I conceive it would, in a measure, simplify the scales to the mind, as the rural districts would represent the Tithe and Inclosure maps, while the town district would represent the sanatory maps of the General Board of Health.

4. "My Lords request that you will inform them of your opinion whether the adoption of these decimal scales will be productive of any practical inconvenience."

The scales such as those named as being in general use on the Continent of Europe, and which are nearly equivalent to scales of 2 feet $1\frac{1}{2}$ inches to the mile for rural districts, and 10 feet $6\frac{2}{3}$ inches to the mile for towns, do not

Replies in favour
of the $26\frac{2}{3}$ inches
and ten-feet scales.

appear to me to be reconcileable to any of our present British scales, although in perfect proportion, I conceive they would tend to practical inconvenience, from the difference being so small, a wrong scale might be applied inadvertently in referring from one class of maps to the others.

No. 8.

MESSRS. NEWTON AND WOODROW, LAND SURVEYORS.

Tombland, Norwich, January 23, 1854.

In reply to your inquiry of the 16th instant, on the subject of the Ordnance Survey, we beg to state that our Firm having been engaged for a period of thirty years and upwards as surveyors under Inclosure Acts, and subsequently for the Commutation of Tithes, that we should recommend, as most generally useful, the second scale, viz.:

A scale of three chains to the inch or $26\frac{2}{3}$ inches to the mile for rural, and of ten feet for town districts.

The scale of three chains to the inch has been used by us for Inclosure and Tithe Surveys, and will, we believe, be found in this and the adjoining county to have been commonly adopted.

We see no objection to the third scale, for surveys, in your letter, other than its differing with the scale to which most existing maps have been planned.

No. 9.

MR. RICHARD PEYTON, LAND SURVEYOR, &C.

Cook's Court, January 16, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th inst. respecting the Scales proposed to be adopted in laying down the Ordnance Survey. The great object is accuracy and perspicuity. Taking these as settled principles, I fear the scale proposed for the towns will hardly be sufficiently large. You will please to bear in mind that in London, and also in the Country, particularly in the manufacturing districts in the north, the population is very dense and the buildings most inconveniently erected, nearly excluding sun and air.

A three-chain scale for *Rural* districts will answer every purpose for the survey, but I fear that the proposed scales for *Towns* will not be sufficiently large, as there are many populous villages composed of small erections, and which, I beg leave to submit, it would be very desirable to lay down with the utmost accuracy.

On the termination of the American war, the Duke of Richmond, the Master General, formed a plan for the survey of the County of Sussex; and two persons, Messrs. Yeakell and Gardner were engaged by his Grace. The intention was to survey the roads, rivers, and every other place of importance accurately, and to fill in each field as near as possible in its proper situation. The county did not respond to Messrs. Yeakell and Gardner as they expected, and the work, so far as completed, was sold to Mr. Faden, and the remainder was put into the hands of Mr. Thomas Gream and completed by him, but in a very inferior style to what it was commenced, and which was considered superior to any pen and ink drawing at that time in existence.

I trust I may be excused for writing so long a letter, but I thought it right to call your attention to the Sussex plan, as I thought it might lead to the adoption of some plan similar to the one sanctioned by the Duke of Richmond.

No. 10

MR. JOHN NEIGHBOUR, LAND SURVEYOR.

Headington, near Oxford, January 23, 1854.

In reply to yours of the 16th instant, I beg to state that a scale of three chains to an inch for rural districts would be, in my opinion, preferable to any other, it being a scale sufficiently large to describe everything required in general surveys—not only lands, but buildings of farms and villages; and as all

practical surveyors are conversant with this scale, it would much facilitate and expedite the work of surveying, and be more intelligible, as I conceive, than any other.

Replies in favour
of the 26 $\frac{2}{3}$ inches
and ten-foot scales.

As to the towns, I think one chain to the inch would be quite sufficient to describe everything requisite in a neat and clear manner.

I conceive the adoption of the decimal scales would be productive of very great practical inconvenience.

No. 11.

MR. J. H. COTTERELL, LAND AGENT AND SURVEYOR.

Bath, January 23, 1854.

I have duly received yours of the 16th., requesting my opinion as to certain scales to be adopted in the Ordnance Survey.

I am of opinion that the most useful scale of those proposed would be three chains to an inch for rural, and ten feet to a mile for town districts, though for the latter I would recommend a scale of sixty or seventy links to the inch. It is worth consideration whether four chains to an inch (twenty inches to a mile) would not be a more useful scale for rural districts. I can see no advantage in the adoption of the continental plan of a map bearing a certain proportion to the linear distance.

It must be borne in mind that when scales have to be used with maps, in nearly all cases a *Surveyor* is the party concerned, and surveyors almost invariably use the decimal scale; in fact, the great majority of scales used and sold are decimal scales.

No. 12.

MR. WILLIAM HEARD, LAND AGENT AND SURVEYOR.

St. Margaret's, Ware, January 23, 1854.

I beg to acknowledge the receipt of your letter relative to the scales of the proposed Ordnance Survey.

I consider the scale of three chains to the inch, or 26·666 inches to the mile, is the smallest scale that should be used for rural districts; that scale has been generally adopted in, I believe, most of the good surveys made during the past forty years; and should the new Ordnance Survey be made on the same scale, there would be a great facility in identifying old boundaries of parishes, properties, titles, &c.

I should strongly recommend that whatever scale is adopted for the rural districts, that for the towns should be five times larger; which, with the three-chain scale would give 11·111 feet to the mile.

No. 13.

MESSRS. WRIGHT AND SON, LAND SURVEYORS, &c.

Norwich, January 23, 1854.

In reply to your Circular, dated the 16th inst., received this morning, we beg to give it as our opinion that the scale No. 2. would be most accommodating to surveyors in this country.

A very perfect map might be made on Scale No. 3.; but, to avail themselves of it, all surveyors would have to provide themselves with a new set of scales not yet manufactured in England.

The three-chain scale is the standard adopted in the Tithe Office, and generally found to be the most useful for working purposes.

No. 14.

MR. WILLIAM BROWN, LAND SURVEYOR, &c.

Tring, January 23, 1854.

I have the honour to acknowledge your Lordships letter of inquiry on the subject of the Ordnance Survey, and to state that maps drawn to a scale of three chains to an inch have been almost universally adopted of late, and found in practice the most convenient. The maps used by the Inclosure Commission are drawn to this scale, and I am of opinion that all public maps should correspond, reduced to the size mentioned in the second paragraph of your Lordships circular.

I beg to be allowed to add my opinion, that for parish surveys none other than maps drawn to a scale of three chains to an inch should be passed in any department of the Government, and that such map should comprise the entire parish, be numbered consecutively, and approved by authority, so as to become ultimately useful as a reference both for public and private purposes.

No. 15.

MR. JAMES FORSYTH, LAND AGENT.

Dunach, near Oban, January 21, 1854.

I have to acknowledge the receipt of your communication of the 16th inst., on the subject of the Ordnance Survey. Not having read the arguments for the adoption of the decimal scales, of $\frac{1}{2500}$ for rural districts and $\frac{1}{500}$ for towns, in preference to the others suggested, I do not feel competent to offer the Lords Commissioners of Her Majesty's Treasury a decided opinion on the question they have submitted for consideration.

At the same time, I do not think that the adoption of any such scales, bearing a definite numerical proportion to the linear measurement of the ground to be mapped, would be productive of practical inconvenience if the scale be expressed, not only in decimal parts, as, for instance, of a mile, but in feet and inches, and also in chains and links, for ready adjustment and comparison with existing plans. The scale of three chains to the inch has the advantage of bearing a definite and convenient relation to all these ordinary measures of length, as well as of surface, without the complication of fractions.

No. 16.

MR. WILLIAM KEEN, ESTATE AGENT AND VALUER.

8, Cannon Row, Parliament Street, Westminster,
January 24, 1854.

In answer to your communication, dated the 16th inst., I beg to inform you that the scale I should recommend and prefer, for the purpose of the Ordnance Survey, would be three chains to an inch for the rural districts, and ten feet to the mile for the town districts. This scale I have always found large enough to show every thing required in a survey, and it has been a great deal used under the Tithe Commutation. I beg, at the same time, to add that I see no practical inconvenience that would arise from the adoption of the decimal scales.

No. 17.

MR. WILLIAM DICKINSON, LAND SURVEYOR, &c.

North Mosses, Cockermouth, January 23, 1854.

In obedience to your Lordships request of the 16th instant, I beg to observe that the "2d" scale, being the one on which a great number of the maps in this county are constructed, would appear best adapted for the maps of the Ordnance Survey, and would render them most convertible to the uses of the country.

In reply to the latter request as to whether the adoption of these decimal scales would be productive of any practical inconvenience, I am not apprehensive that any practical inconvenience will arise from their use.

No. 18.

Replies in favour
of the 26 $\frac{1}{2}$ inches
and ten-feet scales.

MR. MOSES DODD, LAND SURVEYOR AND AUCTIONEER.

16, New Broad Street, City, January 24, 1854

In compliance with your request, I beg to state, that in my opinion the scale of three chains to an inch for rural districts, and ten feet to the mile for towns, are the scales I should recommend for the purpose of an Ordnance Survey. Such scales have been generally adopted and approved by practical surveyors in recent surveys as the most suitable for defining those objects for which plans are usually made, and for ascertaining the areas or quantities. I beg further to add, that the fractional scale referred to, would, in my opinion, lead to much confusion, and I do not see that any convenience could be derived from its adoption.

No. 19.

MR. J. BAILEY DENTON, LAND SURVEYOR, &c.

52, Parliament Street, Westminster,
January 25, 1854.

I have to acknowledge your Lordships circular of the 16th instant, and in reply would beg to state, that having regard to the facts that at least nine-tenths of the maps made in England have been originally plotted to a scale of three chains to the inch, and comprise a considerable proportion of the first-class maps made for the Tithe Commutation, and that thereby all persons, professional and otherwise, have become familiarized with it, I am of opinion that the second scale set forth in your Lordships circular will be found the best to be continued for the perfecting of a uniform survey of England.

Were no reference made to existing maps, I see no objection to the adoption of the decimal scales.

Accepting your Lordships inquiry as an earnest of an intention to carry out a uniform and complete survey of England which will not only serve all purposes connected with the transfer of land, but may be made the basis of all public and private improvements,

I have, &c.

No. 20.

MR. CHARLES M. BIDWELL, LAND SURVEYOR, &c.

Ely, January 24, 1854.

In answer to your inquiry as to my opinion on the three lists of scales for plans to be adopted for the Ordnance Survey, I beg to inform you that, if it is proposed to adopt so large a scale for such plans, that I consider the second is the best of the three submitted in your circular, viz., three chains to the inch for rural, and ten feet to the mile for town districts.

I am induced to adopt this opinion from the fact, that most of the first-class plans made under the Tithe Commutation and Inclosure Acts are plotted on the three-chain scale, and the same scale has been many years used by most practical surveyors in the inclosure of parishes and in accurately working out the quantities of estates; and the ten feet to the mile for town surveys made under the Board of Health. In the present day, and until the decimal coinage is become the rule of the land, I consider the decimal scale would be productive of practical inconvenience.

As the Ordnance Survey is not, I presume, intended to give the quantity of every piece of land, like a parish survey on a three-chain scale, I confess I am surprised at the *large scale* proposed to be adopted, and consider that, for all practical purposes, for showing the details and a good plan of the country a *very much smaller scale* would be of greater service to the community at large.

Replies in favour
of the $26\frac{2}{3}$ -inches
and ten-feet scales.

No. 21.

MESSRS. THOMAS and HENRY COOPER, LAND SURVEYORS, &c.

Canterbury, January 24, 1854.

We have the honour to acknowledge the receipt of your communication of the 16th inst. in reference to proposed Ordnance Surveys, and have to inform you that our opinion (provided it be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made,) that the scale of three chains to the inch, or $26\frac{2}{3}$ inches to the mile for rural districts, would be best adapted for general purposes, as it has been found sufficiently large to attain accuracy and faithful delineation on paper, and it would also correspond to the scale used on all first-class surveys and maps made under the Tithe Commutation Act, which in our opinion would be very desirable, as the plans of the various parishes might then assist in the detail of the Ordnance Surveys, and the Ordnance Survey would be the means of determining the accuracy of the parish plans. And we are also of opinion that two surveys made at different times by authority, on different scales, would lead to great confusion in adaptation to the usual objects for which such plans are made.

And we are further of opinion that the scale to be used for the town districts, should bear some definite numerical proportion to that used in rural districts, and from our own experience we should think that the scale of one chain to the inch, or six feet eight inches to the mile would be sufficiently large for towns, and which would be equivalent to $\frac{1}{2376}$ for rural, and $\frac{1}{792}$ for town districts.

No. 22.

MR. T. W. RAMMELL, CIVIL ENGINEER.

4, Trafalgar Square, January 26, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th instant, wherein you request my opinion upon certain proposed scales for the Ordnance Survey for the information of the Lords Commissioners of Her Majesty's Treasury.

Before examining the relative merits of the scales specified, I would beg leave very briefly to call the attention of their Lordships to a consideration which I think it is important should be borne in mind, when deciding upon scales for surveys intended for general application.

By long consent and custom, the unit of measurement, commonly employed in surveys, has been, in rural districts the link, and in town districts the foot; whilst in plotting, in both cases, the inch has been the unit almost universally made use of. I submit that it would be highly inconvenient to interfere with the continued use of the accustomed units for measurement in combination with the accustomed unit for plotting in the manner heretofore practised; and that it would be desirable that the scales to be adopted should be such, that in the case of rural districts the link, or multiples of 10 thereof, and in the case of town districts the foot, or multiples of 10 thereof, should be readily referable to the inch upon the plotting scales.

With regard to the three proposed schemes described by you, the proportions observed in them do not differ greatly, and in that respect, I think them to be such as would be generally convenient for practical purposes. But I have now to consider them in reference to the principle I have just suggested, and, with one exception, I find them to be at variance with it.

Scheme No. 1. This scheme is objectionable because the scale proposed for rural districts, involves a proportion of 333.33 links to an inch, and that for town districts a proportion of 44 feet to the inch; neither of them being multiples of 10.

Scheme No. 2. I approve of a scale of 3 chains (= 300 links) for rural districts, it being a multiple of 10; but I disapprove of the proposed scale for town districts for the reason stated in respect to it under No. 1.

Scheme No. 3. This proposition is open to two objections; first, that the proposed scales would indicate proportions in terms not easily appreciable to the

mind, and secondly, that they would be incompatible with the continued use of the link and foot for measurement in combination with the inch for plotting. I think that great inconvenience would result from the adoption of these scales without any countervailing advantage.

Replies in favour
of the 26 $\frac{3}{4}$ inches
and ten-foot scales.

Their Lordships will perhaps pardon me if, before concluding, I venture to suggest the scales which, having regard to the objects I apprehend to be in contemplation, I think it would be most advisable to adopt,—they are:

- 1st. One of 3 chains (300 links) to the inch for rural districts, and
- 2d. One of 40 feet to the inch* for town districts.

No. 23.

MR. DAVID STEVENSON, CIVIL ENGINEER.
(See No. 11 at page 234.)

No. 24.

MR. RICHARD C. GALE, LAND SURVEYOR, &c.

Winchester, January 25, 1854.

I have the honour to acknowledge the receipt of your favour of the 16th instant, on the subject of the proposed Ordnance Survey.

Assuming that "it be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made," I am of opinion that the second scale on the list is best calculated to carry out the objects of the Lords Commissioners of Her Majesty's Treasury.

I have my doubts whether ten feet to the mile for town districts is not fully large, and whether that scale might not be improved by reducing it one-third, making 6·667 feet to a mile, and one chain to the inch.

The 3-chain scale has been found to work well for all purposes of sale and purchase of estates in rural districts, but not too large when accurate quantities are required. Besides which, the first-class 3-chain maps already in the Tithe Office, would, I imagine, be made available. These have been examined and tested with great care and judgment, under the supervision of Colonel Dawson.

3rd. I think the adoption of decimal scales would be attended with some practical inconvenience, inasmuch as a large portion of the kingdom has been accurately mapped on other scales, both for Tithe and Inclosure purposes.

No. 25.

SIR PHILIP GREY EGERTON, BART.

Oulton Park, Tarporley, January 24, 1854.

Supposing it to be determined that the Ordnance Survey shall be on a scale sufficiently large to comprehend all the objects for which surveys and plans are usually made, I am of opinion that the second of the three plans submitted to my consideration will be in all respects the most useful. A considerable portion of England has already been mapped on the scale of three chains to the inch for the Tithe Commutation, and having had to consult those maps frequently for various purposes, I have found them quite satisfactory. I am still of the opinion expressed in my former letter, that the greatest desideratum is the completion of a general map of the United Kingdom on the scale of one inch to the mile, and that no operations on a larger scale should be undertaken if they are calculated in any way to interfere with the progress of that work.

No. 26.

MESSRS. J. P. STURGE AND SONS, LAND AGENTS AND SURVEYORS.

We beg to acknowledge the receipt of your letter of the 16th instant, requesting us to give our opinion to the Lords Commissioners of the Treasury, as to which of the scales therein mentioned we should recommend, supposing it should be determined that the scale should be sufficiently large to comprehend all objects for which surveys and plans are usually made.

* Eleven feet to a mile.

Replies in favour
of the $26\frac{2}{3}$ -inches
and ten-feet scales.

In reply, we beg to state that there may, in our opinion, be an advantage in adhering to the scale of three chains to an inch for rural districts, as being the scale on which most of the first-class maps were made for the purpose of the Tithe Commutation.

It would be a convenience for the purpose of reduction from the scale adopted for the town districts to that adopted for the rural districts, or to any intermediate scale, that the one should bear a definite proportion to the other, and if, therefore, the scale of three chains to the inch be adopted for the rural districts, we think that for the town districts should be in the even proportion of four or five to one, instead of that of 10 feet to $26\frac{2}{3}$ inches.

We are not, however, aware that the adoption of a decimal scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{5000}$ for town districts, would be productive of any practical inconvenience, and this scale would, in our opinion, be preferable to that of 24 inches to the mile for rural, and 10 feet to the mile for town districts.

No. 27.

MR. J. MARMONT, LAND AGENT AND SURVEYOR.

Bristol, January 23, 1854.

In reply to the inquiry of the Lords Commissioners of Her Majesty's Treasury, on the subject of the Ordnance Survey, I beg to state, that of the scales mentioned in your letter of the 16th instant, those in the second class, viz.:

"A scale of three chains to the inch, or $26\frac{2}{3}$ inches to the mile for rural, "and of ten feet to the mile for town districts," would, in my opinion, be the most useful for practical purposes, particularly as regards rural districts, the existing plans thereof being laid down to scales of chains forming an aliquot part of the inch.

As respects the decimal scales in the third class, I think their adoption might be inconvenient from their bearing no aliquot proportion to the scales hitherto in use.

No. 28.

MR. ARTHUR BIDDELL, LAND VALUER AND SURVEYOR.

Playford, Ipswich, January 25, 1854.

I have the honour to receive the circular question from the Lords Commissioners of Her Majesty's Treasury as to my opinion of the scale most advisable to be adopted in an Ordnance map, for objects for which surveys and plans are usually made.

I think (of those scales mentioned) that of three chains to an inch most advisable; first, because on that scale all the first-class maps are made under the Tithe Commutation; secondly, because if that scale be used I see no occasion for different scales for town and rural districts. I remember valuing the town and lands of Hadleigh with a map on that scale as my only guide, and had no difficulty in finding every building, lane, public passage, and every small plot of land. With such a map I have, without any difficulty, valued several other large places and considerable towns.

Adopting the decimal scale used on the Continent will be inconvenient in England, which will not be wholly met by a scale of links on the statute chain engraved on the map, by which measurements could be made. By that old chain (the almost only decimal measure we have), every acre, or nearly so, of land in the kingdom has been measured, and a deviation from it, in an Ordnance map, would occasion a complexity and should be avoided, unless the very comprehensive but remote object be aimed at—that of assimilating, if not making identical, all the measures, weights, and coins in Europe and America. This may be possible if general assimilations be persevered in by common consent, but would have to be finished by another generation if begun now.

If such a national map be made as that in contemplation, I will take the liberty of suggesting an addition to the ground plan for giving facility to

engineering plans for extensive draining, railways, and other purposes, where the level or heights of a country are required. For such objects it might be important, on an Ordnance map, to denote in plain figures, at the junction of considerable streams and at the junction of roads, the heights of such places above the sea. This would give the relative heights of places to each other.

Replies in favour
of the $26\frac{2}{3}$ inches
and ten-feet scales.

As no other scale of maps than those in the circular letter were mentioned, I apologise for an observation upon maps for general purposes. I have found, in valuing parishes, a scale of six chains to the inch more convenient and quite as correct as those on a larger scale for rural districts, and for towns a map on a scale of two chains to the inch large enough for any public purpose that I know of.

No. 29.

MR. W. H. APPERLEY, LAND AGENT AND SURVEYOR.

Hereford, January 26, 1853.

In reply to the request I have had the honour to receive from your Board respecting the scales which I should recommend for adoption in relation to the Ordnance Survey, I beg to state that I consider that a scale of 198 feet to the inch, or $26\frac{2}{3}$ inches to the mile for rural, and a scale of 10 feet to the mile for town districts, are the most desirable scales to be used for all practical purposes, and sufficiently large to comprehend all the objects for which surveys and plans are usually made.

I am of opinion, that the decimal scales of $\frac{1}{2500}$ for rural, and $\frac{1}{3000}$ for town districts, or that proportion of the linear measurement, and the proximate equivalent of $25\frac{1}{3}$ inches to the mile for rural, and $126\frac{2}{3}$ inches to the mile for town districts may certainly be adopted, but would be attended with practical inconvenience; and I feel assured that from the former scales being those upon which $\frac{3}{4}$ ths of the existing accurate maps are drawn, and in other respects being the scales approved by the majority of surveyors, I strongly recommend the scales I first mentioned.

No. 30.

MR. JOHN TOWNE DANSON, BARRISTER AT LAW.

Carnsdale House, near Neston, Cheshire,
January 26, 1854.

In compliance with their Lordships request, I would recommend—

“A scale of three chains to an inch, or $26\frac{2}{3}$ inches to the mile for rural, and
“ of 10 feet to the mile for town districts.”

The preference I give to the scale of three chains to an inch for rural districts is founded, in great part, on personal knowledge, acquired as an owner and cultivator of land, of the great practical convenience of a ready reference from the map to the statute acre—now, and likely long to be, the common measure of rural surface in this country.

On the Continent, wherever the decimal system prevails, the same reason would, as of course, found a just preference for a ready reference to the Hectare.

Of the scale for town districts, I cannot speak with much confidence. But I think 10 feet to a mile (or $\frac{1}{3000}$) better than 10 feet $6\frac{2}{3}$ inches (or $\frac{1}{3600}$), because I think it would, in England, be found simpler and more useful in practice.

The adoption of any decimal scale would, in my opinion, be productive of practical inconvenience, precisely in proportion as it should cause fractional differences between the linear scale adopted and the superficial scale in common use.

I may add that, in voting against a decimal scale, I would not be understood to doubt that we should be large gainers by reconciling all the formulæ

Replies in favour
of the 26 $\frac{2}{3}$ -inches
and ten-feet scales.

of our monies, weights, and measures, to those of our arithmetic. I speak of the map in question only as a map of England, for English use, and with the present English land measure.

No. 31.

MR. THOMAS MORRIS, LAND SURVEYOR, &c.

Newport, Monmouthshire, January 27, 1854.

In having the honour to acknowledge the receipt of your Lordships letter of the 16th instant, in reference to the scales most desirable to be adopted on the Ordnance Survey, I beg to state that a scale of three chains to an inch for rural, and of 10 feet to the mile for town districts, would in my opinion, be the most desirable, and sufficiently large to comprehend all the objects for which surveys and plans are usually made.

In adopting a three-chain scale for rural districts, much benefit would accrue to the public at large, inasmuch as all the first-class maps (made under the directions of the Tithe Commissioners) having been laid down on that scale, much time would be saved in comparing or checking them with any new Government Surveys.

As regards the larger scale for town lands, 10 feet to the mile being the scale recommended by the Board of Ordnance, and afterwards adopted by the General Board of Health, many towns in consequence have been already mapped on that scale, and therefore I think it advisable to adopt the same in any future surveys.

In reference to the adoption of decimal scales, I think in a new country it would be very desirable; but as the whole, or nearly so, of the kingdom has been laid down on the chain scale, much inconvenience would arise, I presume, in comparing existing maps and surveys with those made on the decimal principle.

No. 32.

MR. J. A. NOCKOLDS, LAND SURVEYOR, &c.

Stansted, Essex, January 28, 1854.

Your letter dated the 16th instant, and addressed to the late Mr. Martin Nockolds was opened by me, his son and successor.

Having been for many years in my father's office during his life time, I was by him habituated to the use of the second scale mentioned by you, viz.: the scale of three chains to the inch, and I was taught to consider that scale as the one most suitable for use in the survey of parishes and commons under inclosure acts, both local and general, the Tithe Commutation Act, and the act regulating parish assessments. I have so continued to use that scale, believing that the one, *sometimes* used, of four chains to the inch to be too minute to represent the features of the locality surveyed, distinctly; and the larger scale of two chains to the inch, to be too unwieldy when applied to a large district, to be convenient and portable, (I speak of the map constructed therefrom) but I must in justice say, that the force of habit, and prejudice arising from early instruction have prevented my giving a fair trial, perhaps, to any other than the three chain scale. I have not been singular, however, in thus preferring it, as my father's late contemporaries, the two Messrs. Jackson, formerly of March and Barkway, Mr. Watford of Cambridge, and the late Mr. King of Saffron Walden, (formerly assistant, and some time a partner with my late father, for whom he surveyed a very large extent of country) almost invariably used the above mentioned scale. It would be, I think, extremely difficult to find five persons who stood higher as surveyors and Inclosure Commissioners, or who had surveyed a larger extent of country in Cambridgeshire, Lincolnshire, Huntingdonshire, Norfolk, Suffolk, Essex, Herts, &c.

I have had no practice in town surveying, and cannot therefore give any opinion thereon.

As to the scales mentioned by you in the third place, I think some little practical consideration of them to be required before venturing an opinion,

but I certainly also think that *some* advantages would result from the adoption of such scales, especially if, by their use, a general standard of admeasurement throughout Europe could be effected; but whether such advantages would be counterbalanced, or more than counterbalanced, by inconvenience in use, I must leave to those who have had more variety in practice with regard to these and other scales to decide. Altogether, it would take much persuasion and argument to shake my adhesion to the scale of three chains to the inch for inclosure and general purposes, more especially the former.

Replies in favour
of the $26\frac{2}{3}$ inches
and ten-foot scales.

No. 33.

MR. JOHN LANCASTER, MINERAL AGENT, &c.

Shelton Colliery and Iron Works, near Newcastle,
Staffordshire, January 30, 1854.

I am in receipt of your circular of the 16th instant requesting to be informed which scale I would recommend of the three several ones proposed. The scale I would recommend is that placed second in the category, viz., a scale of three chains to the inch, or $26\frac{2}{3}$ inches to the mile for rural, and of ten feet for town districts. The strong reasons I see for adopting this scale are that it is now so very generally adopted for all Tithe Surveys and all ordinary parish matters, and that for practical purposes it is found to answer so well. It affords every facility for enlarging and copying off where necessary.

With regard to the third or decimal scale, my opinion is that its adoption would be attended with the great difficulty of upsetting all existing arrangements and introducing an entire new system; and I, on the other hand, can see no advantages to compensate for the change.

No. 34.

MR. CHARLES F. ADAMS, LAND SURVEYOR, &c.

Barkway, January 29, 1854.

Allow me to acknowledge the receipt of your letter of the 16th on the subject of the Ordnance Survey, and in reply I beg to inform you that, in my opinion, the scale best adapted for the objects for which surveys and plans are usually made is three chains to the inch for rural, and ten feet to the mile for town districts. I am also of opinion (although I give the preference to the foregoing scales) that the adoption of the decimal scales of $\frac{1}{2500}$ and $\frac{1}{300}$ would be productive of no practical inconvenience.

No. 35.

MR. GEORGE P. BIDDER, CIVIL ENGINEER.

24 Great George Street, Westminster,
February 1, 1854.

I have the honour to acknowledge a communication from the Lords Commissioners of Her Majesty's Treasury requesting my opinion as to the scales for Ordnance Survey Maps best adapted for general purposes.

If there were no alternative as to adopting one out of the three propositions laid down in that communication, I should decide in favour of the second, for although speaking theoretically, the third is the best; yet taking into consideration how many existing plans have been constructed on the three-chain scale, and how general its use among engineers and surveyors, I think it is the most desirable on the whole.

In addition to the Ordnance Map of one inch to a mile, which is of great value, I should prefer an enlarged plan to a scale of eight chains to the inch, which would not be too unwieldy for convenient use, and quite adequate for practical purposes; indeed, I do not consider it important to have large plans of towns, which are continually undergoing alterations, and of which new surveys are constantly required, in order efficiently to carry out improvements.

Replies in favour
of the $26\frac{2}{3}$ inches
and ten-feet scales.

No. 36.

Mr. JOHN WATSON, JUN., LAND SURVEYOR, &c.

Kendal, February 1, 1854.

In reply to your Circular of the 16th ult., relative to my opinion on the different scales proposed for the Ordnance Maps, I beg to state that my opinion is in favour of three chains to the inch for the rural districts, and of ten feet per mile for the urban districts. These scales, I feel persuaded, will be equally simple and much more popular than the others submitted for my opinion thereon.

No. 37.

Mr. JOHN ROBISON WRIGHT, CIVIL ENGINEER.

Manchester, January 31, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th instant, requesting my opinion on three proposed scales for the Ordnance Survey, "supposing it to be determined that the scale shall be sufficiently " large to comprehend all the objects for which surveys and plans are usually " made."

The three scales named for rural districts are 24 , $25\frac{1}{3}$, and $26\frac{2}{3}$ inches to the mile, while for towns the scale is 10 feet and 10 feet $6\frac{2}{3}$ inches to the mile.

It is at once evident, that the proposed scales approximate in size so nearly that any of them would be large enough to comprehend all the objects above named. The only point, therefore, to be considered is, which of them is the most convenient and desirable on the whole, and calculated to produce the greatest amount of practical usefulness to all persons using the map.

Some of these considerations appear to me to be as follow :

That while, as a general question of science, it is highly desirable to preserve a uniformity of scale in all national surveys for the purpose of statistical inquiries &c., and that while this agreement is doubly strong in the case of all countries situated on one and the same continent, the question is still open for consideration whether, in the case of Great Britain, there may not be other and more important arguments why this uniformity should not be enforced.

1. The first which naturally occurs is, that from its insular position, there is not any neutral ground which it might be desirable for two adjoining countries to include in each of their national surveys, on account of boundaries, fortifications, police regulations, customs, or other important objects arising out of their juxtaposition.

2. Another consideration is, that in England there has existed for centuries a basis of measurement founded on our own standard yard. Twenty-two of those yards form a measure, which by law, constitutes a statute chain; and it is hardly necessary to add, that ten of those chains in length, and one in width, are the dimensions of an English acre.

Hence the statute chain and its relation to the inch, has usually—almost invariably—formed the basis in determining the scale on which land plans are drawn in England. Of these, multitudes already exist for all the purposes of civil and social life among us; and the plans of parishes and townships made under the direction of the Tithe Commission alone, during the last seventeen years, amount to the large number of upwards of 12,500, drawn chiefly either on a scale of three or six statute chains to an inch.

3. But the basis of measurement on the Continent has no reference to this statute chain or English yard. It is a chain formed by the multiple of the French metre. While, therefore, the scales adopted on the Continent for drawing the map are convenient and well understood there, they would be troublesome and inconvenient in England, where another system has long been generally in use, and where the proposed alteration would be likely to be only partially adopted for many years.

Hence there would probably result some degree of confusion from the existence of old style and new style in measurement, augmented as it would be by the fractional nature of the new arrangement.

If indeed, as in the case of the change from the old to the new style of computing time, it could be shown that the necessity was imperative, that argument would at once outweigh every one based on temporary inconvenience. But I am not aware of the existence of any such imperative necessity: arguments there no doubt are, on that side of the question, otherwise they would not be recommended by the Statistical Societies of London and Brussels; but still their force and practical value are to be fairly tested in taking a complete view of the whole subject.

Replies in favour
of the $26\frac{2}{3}$ inches
and ten-feet scales.

As far as my present information extends, I am therefore of opinion that it is not necessary to adopt the Continental system, and that we have therefore only to choose between the scales of 24 and $26\frac{2}{3}$ inches, to a mile.

The latter, being the scale of three statute chains to an inch, is so well known and so generally used by the great majority of all classes of persons either making or using plans of rural districts, both in England and Scotland, that I should have given my humble vote for its adoption, had I not found that a gentleman of so much experience in these matters as Colonel Dawson had given the sanction of his authority to the former.

The question, however, seems to narrow itself into this: shall we keep the scale of the public map the same with that of so many plans already existing in this country, or adopt new scales whose chief recommendation is that they are multiples of each other? This would, no doubt, prove to be a convenience in making reduced drawings: and whether that convenience is a matter of such importance as to outweigh the consideration of having the national map on what may almost be called the national scale, I will not undertake to determine. But considering the skill and advanced science of the present day, I should scarcely have thought that the practical difficulty of reducing the three-chain scale to any other would have been such as to have made it necessary to depart from a scale, which, were it not for such considerations, so many different parties would unite in thinking the best for the purpose.

No. 38.

MR. THOMAS BELL, LAND SURVEYOR, &c.

Newcastle, February 1, 1854.

Absence from home has prevented my earlier answering the question proposed in your circular, dated the 16th ultimo, which I regret:—

The question is an important one; yet, however desirable it may be to adopt a decimal system, I am afraid the benefit accruing would be more than counterbalanced by inconvenience felt in practice, and I am decidedly of opinion that a scale of three chains to an inch for rural, and of ten feet for town districts, as mentioned in your second proposition, would be found most generally useful.

No. 39.

MR. JOHN M'MILLAN, LAND AGENT, &c.

(See No. 49, at page 300.)

No. 40.

MR. W. BRYAN WOOD, LAND SURVEYOR.

Chippenham, February 3, 1854.

I have the honour to acknowledge the receipt of your letter on this subject.

Presuming that if the survey were made on one of the scales mentioned, it would be published for the use of the public generally, I believe that either the first or second scales mentioned for rural districts would be more available and better understood than the third, as an even number of chains to the inch, or even number of inches to the mile, would be obtained by those scales, and feet and inches are familiar to every one living in rural districts likely to use such maps, and a foot rule or some measure of inches would be at hand in most of their houses.

Replies in favour
of the $26\frac{2}{3}$ inches
and ten-feet scales.

There seem to me to be advantages in the first and second scales, which in some degree balance each other, but I would recommend of the two the use of the scale of three chains to the inch, as with that an inch would represent an even number of chains, which I consider to be more convenient for plans than a scale of chains, and parts of a chain, to the inch, such as in the scale of twenty-four inches to the mile; and as land surveyors generally use scales of an even number of chains to the inch, it would appear those were scales of the most practical convenience.

If I may take the liberty, I would suggest the use of a scale of four chains to the inch, as that would embrace the advantages I consider the three chains to the inch possesses, as well as the advantage, in the twenty-four inches to the mile, of an even number of inches to the mile, and a smaller plan; and, taking into consideration all the objects for which surveys and plans are usually made, I am of opinion that a scale of four chains to the inch would more nearly arrive at them than either of the other three scales. Accuracy of quantities may be obtained by it, and as plans on that scale would not be so unwieldy as on the other scales, they would be very much better for reference.

No. 41.

MR. ALFRED GILES, CIVIL ENGINEER.

9, Adelphi Terrace, February 3, 1854.

In answer to your inquiries respecting the scales at which the proposed Ordnance Survey should be plotted, I beg to state that my experience leads me to the conclusion that a scale of three chains to the inch would be more practically convenient than one of 24 inches to the mile.

I am also of opinion that the adoption of the decimal scales would cause great practical inconvenience to the present generation of engineers and surveyors; and although I am aware that the decimal scale is generally adopted on the Continent, I have failed to discover any advantages arising therefrom. If the decimal system were extended to all English measures, I would then recommend the same system to be applied to plans.

No. 42.

MR. LUCAS H. SPOONER, LAND AGENT.

Munlochy, N. Brit., February 5, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th January, requesting an opinion as to which of the three scales named therein I should recommend for adoption.

The scales alluded to may be represented relatively to each other, and to the methods of measurement in common use, as follows, viz.:—

	Numerical proportion to the Land mapped. Rural.	Chains to the inch.	Chains to the Foot.	Inches to the Mile.	Proportion Towns to Rural at 10 Feet per Mile.
1st.	$\frac{1}{2840}$	dec. recurt. $3\cdot3333$, &c. or $3\frac{1}{3}$	40	24	$5\frac{1}{2}$ or 5 to 1
2d.	$\frac{1}{2378}$	3	36	dec. recurt. $26\cdot6666$, &c. or $26\frac{2}{3}$	$3\frac{1}{3}$ or $4\frac{1}{2}$ to 1
3d.	$\frac{1}{2600}$	dec. recurt. $3\cdot15656$, &c.	dec. recurt. $37\cdot8787$, &c.	decimal. 25'3440	$5\frac{1}{5}$ or 5 to 1

Replies in favour
of the 26 $\frac{3}{4}$ inches
and ten-feet scales.

Of these, the *second* one, viz. that of three chains to the inch, in my opinion, is *practically the best*. It is the scale most commonly used by surveyors and engineers for plotting land measurements; it presents whole numbers of chains and of feet to the inch, though fractional of the inches to the mile,—but reference is more frequent, in the use of maps, to the former than to the latter, the former being applied to almost every computation of area, or accurate linear measurement, while the latter only comes into use in geographic measurements of considerable length. It contains a whole number of chains in length, hence a scale appended to a map can be read from either end without occasioning confusion, and having a whole number of chains to the inch, measurements can be ascertained by applying a common foot rule, or any of the inch graduated scales in ordinary use.

It has advantages over the *first*, by the scale being larger, and by having a whole instead of a small fractional number of chains to the inch. The conversion from the rural to the town scale, and *vice versa*, is equally as easy in it as in the other two, by using 4 $\frac{1}{2}$ or 4·500 as a multiplier or divisor, as the case may be.

It has advantages over the *third* also, in that its scale is larger, and that chains to the inch, and chains to the foot, in the latter, are both represented by fractional quantities, or recurrent decimals, instead of whole numbers.

This scale being more generally used in the delineation of land measurement than any other, is strong evidence in its favour. It appears to comprise all the advantages contained in the other two, and to present some in addition which they do not possess.

In respect to the question, whether “the adoption of the decimal scales” (having reference to the third description) “would be productive of practical inconvenience,” I am of opinion that it would not inconvenience surveyors or other professional persons, because they would provide themselves with graduated scales adapted to the decimal computation; but that it would not be as convenient to the public at large, unless the present system of subdivisions were done away with and a decimal system of measurement universally adopted. Again, in the measurement most referred to, viz., chains to the inch, the fraction over three chains is so minute, that, unless the scale were described in words when laid down on any plan or tracing, the shrinkage or contraction of the paper (known to take place) would simply make it appear as a scale of three chains to the inch, and thus tend to create inaccuracy in the extension of the scale to measurements upon the plan.

No. 43.

MR. SAMUEL VESSEY, LAND AGENT.

Manor House, Halton, Spilsby, February 9, 1854.

In reply to your letter of the 16th ult., I beg to state that of the three scales to which you have turned my attention, I am of opinion that the *second*, or scale of three chains to the inch, or 26 $\frac{3}{4}$ fathoms to the mile for rural, and of ten feet for town districts, is the most preferable.

No. 44.

MR. WILLIAM GRAVATT, CIVIL ENGINEER.

15, Park Street, Westminster, February 14, 1854.

In answer to the circular from the Lords Commissioners of Her Majesty's Treasury, which I have had the honour of receiving, I beg leave to submit through you, the most careful conclusion on the subject my experience has enabled me to form.

For rural districts I prefer a scale of three chains to the inch to any other scale mentioned in the circular, that being the scale commonly used in England for parish plans, and full large; indeed, for plans of considerable estates I think half the size, or six chains to the inch, much more convenient.

Plans for town districts on a scale of ten feet to the mile, would, I consider, be of little, if of any, use to the engineer. I should for waterworks, or for drainage purposes, greatly prefer a scale of about one foot to the mile, or say six chains to the inch, many very useful town plans being now only ten inches

Replies in favour
of the 26 $\frac{1}{2}$ inches
and ten-feet scales.

to the mile, or eight chains to the inch. If to the admirable one-inch-to-the-mile shaded Ordnance maps, be added published town plans of six chains to the inch, I consider the Engineer supplied in the most convenient manner for the public benefit and his own reputation.

As to making the plans of either rural or of town districts any particular fraction of the natural size, I conceive the idea unpractical.

I prefer the decimal mode of measuring and of calculating to any other, and have always used it, even in money matters.

No. 45.

MR. J. K. BRUNEL, CIVIL ENGINEER.

18, Duke Street, Westminster, February 15, 1854.

The question put to me, in your circular of the 16th, would appear to limit me strictly and simply to a choice between three scales named therein. But, to reply to such a question usefully and without leaving my opinion open to misconstruction hereafter, I find that I cannot confine my answer within such narrow limits. In the first place, I should not feel able to make a selection at all without knowing whether these are the only plans to be given to the public, or whether they are to be accompanied, or rather, as I should hope, preceded, by the one inch shaded map, which I consider far more valuable than any other, and without which I consider any enlarged maps would be of so little value, that I should feel no interest as to what scale they were published upon, and should find it difficult, even if I attempted it, to come to any conclusion, except perhaps, under any circumstance, to reject the third scale and the decimal system involved in it.

Assuming, however, that the one inch scale is to be published, as practically valuable in at least the proportion of ten to one, compared with the enlarged ones, I should, if compelled to adopt one of the three scales named for a larger map in addition to the one inch, give the preference to the second.

In England, the majority of persons using such maps are not professional or practised measurers, to whom the impression conveyed on the mind by the unit of measure might be comparatively unimportant, but are generally persons who are unaccustomed to work with imaginary or algebraical quantities; and, unless the unit used is one conveying at once a definite idea, it is in fact an algebraic quantity. To such persons, however, a certain number of chains does convey at once a correct impression of lineal dimensions, and two dimensions of chains gives even an immediate and tolerably correct idea of the area or acreage. The decimal system I consider decidedly defective in this respect, and to be attended in consequence with such serious inconvenience as, in my opinion, to render it inadmissible. I have had a good deal of experience in its use, and can hardly have been prejudiced against it, as I was educated on that system, and had to unlearn it.

Ninety-nine persons in a hundred who use such maps in England would not be furnished with scales divided for the purpose; and it must be admitted that the knowledge that a measurement of $7\frac{1}{2}$ inches say, on the map, represents 2,500 times $7\frac{1}{2}$ inches, conveys no impression whatever of the dimensions; and even when this is elaborated into 18,750 inches, a further calculation must be made to bring the amount into any shape which the mind embraces and realizes. If two or three dimensions are required, and if an area should have to be measured, the calculation becomes one which, simple enough theoretically, would embarrass many people; and in the process of such calculations the mind does not follow the results and check them; but in the end, even with practised calculators, an error of a decimal is as likely as not to be made, and a result obtained ten times too large or too small, without any intermediate check of the mind; whereas, with a three chain scale, the most ordinary and unpractised calculator feels that $7\frac{1}{2}$ inches is about 22 chains, and if the ground be about four chains wide, he feels also that the area must be about 9 acres; the mind at once checks the general result, and a calculation, if made, gives the fractional parts. I believe the decimal system for maps to be full of inconvenience, and to have no one practical advantage for the English public worth a moment's consideration.

I consider the second scale named, preferable to the first, for nearly the same reasons. Fractional parts of a mile, except the half and the quarter, do not in

England constitute units of measurement; but, in the use of a large map, chains are the units most familiar and easily convertible into miles when required, and for areas they are the only ones used. As the separate sheets are not likely to be above 36 inches, the separate measurements can never run up to a number of miles; and within 30 or 40 inches, chains will be the most convenient unit even for parts of a mile; therefore the fractional number of $26\frac{2}{3}$ inches to the mile, involved by the three chain scale, and which might appear to be an objection, would never come into operation. If I had my choice, however, I should now prefer a scale of four chains to the inch, instead of three, which I might have chosen a few years ago.

Replies in favour
of the $26\frac{2}{3}$ inches
and ten-feet scales.

A scale of three chains has been found certainly to give a map which, with the average dimensions of enclosures and of roads, and other things to be represented on a map of England, is perhaps as good a size for drawing and measuring as could be desired; but to ordinary persons, and with the rules and scales in ordinary use, three is a bad multiple; out of every 100,000 ordinary rules or scales in England, I doubt whether more than one would ever be found divided into thirds of an inch, and three is not an aliquot part of ten, which, in square chains, forms our unit of area, the acre; nor of 80, which forms our larger lineal unit of a mile; while a quarter-of-an-inch can always be measured by our common rules, which, with the improved qualities of drawing and engraving, have now become common, and is a dimension almost carried in the eye. I believe that a four chain scale, or 20 inches to the mile, though not of course so clear as a three chain, would be adequate for all practical purposes, and would be superior, with the improved execution, to the present Tithe Maps on the three chain scale, as executed a few years ago. In proof of the sufficiency of a four chain scale, I should mention that for many years I have invariably, and I believe many others have, used this scale satisfactorily, for all the purposes of setting out and purchasing property for railways.

On the same general principle, I object to the 10 feet scale for towns; besides its being so large as to be useless for ordinary purposes, and yet insufficient for those cases requiring details, one chain to the inch, or six feet eight inches to the mile, is the largest scale I have ever found necessary even for detached pieces of property; and yet, when general dimensions are required, this is so large that a plan of any extent becomes unmanageable. Even the five feet map of London is, in my opinion, as far as the public is concerned, a useless map, as it does not (and no published map can) give the details of private property, if any accurate dimensions of parts are required; while so large a scale has the great defect of pretending to an accuracy which no work executed within the limits of ordinary expenditure can possibly give. That such accuracy cannot be depended upon in the London Ordnance, may be easily ascertained. Take for instance sheet 473, on which the basins of Trafalgar Square, or the base of the Nelson Monument, are nearly an inch square,—one would expect to find them correctly laid down; all the dimensions of these parts are nevertheless totally incorrect. If, on the other hand, a distance of a mile has to be measured, or say from Hyde Park Corner to the House of Commons, five separate sheets must be selected, and the route traced out and measured separately on each; the result unquestionably would be that the distance would be more accurately measured on the 12 inch or reduced Ordnance, and the operation would be effected in half the time. Such a survey, if correct, would be a work of art, to be kept in a record office, but useless to the general public.

The four chain scale, if adopted for the rural districts, might perhaps, for the sake of uniformity, be applied to the towns, although I think it much too large for those general uses for which good town maps are mostly wanted. The Ordnance Map of Dublin may be taken as a nearly perfect specimen of a town map on rather a small scale, very nearly large enough for all practical purposes, except such as must always require special surveys embracing the latest changes, and those details of private property, and accurate measurements of parts, which can never be depended upon in a published map, yet this map is on a scale of only six inches to the mile. I should prefer one of about double the scale, but this I think would be sufficient for all general purposes; and where local works require a larger plan, a special one, on a scale specially adapted to the object, must be made containing only that information specially required, whatever it may be,—whether details of private property, or underground drainage, or surface levels, or any other facts,—for some of which purposes five feet,

Replies in favour
of the $26\frac{2}{3}$ inches
and ten-foot scales.

or even ten feet, may not be enough ; while, for general purposes, I believe both of them much too large.

I believe, then, a map of moderate dimensions, viz., of eight chains to the inch, or ten inches to the mile, would be by far the most generally useful town map, and would correspond in its object and general utility to the one-inch for the country. With respect to any enlarged map of towns, corresponding to the four-chain scale of the country, the objects for which it can ever be required, require at the same time a local accuracy, and an amount of detail and special information, corrected up to the last moment, which can never be obtained by a general published map, and therefore any attempt to publish large maps of towns will, I believe, prove a useless expenditure, and will tend to mislead by professing to give that which it cannot.

No. 46.

MR. JAMES WEBB, LAND SURVEYOR, &C.

Worcester, February 15th, 1854.

In reply to your circular respecting the more convenient scales for Ordnance Surveys, I beg to inform you that I consider a scale of three chains to one inch for rural, and ten feet to the mile for town districts, the best for such purposes.

I think the adoption of the decimal scale would be attended with inconvenience, not only to the present practitioner, but in reference to new surveys plotted on such decimal scales, where it would be necessary to delineate thereon metes and boundaries removed since the first-class maps on the three-chain scale were made, of properties held under different titles and names, and also for the general purposes of comparing, testing, &c. &c.

No. 47.

MESSRS. DANIEL SMITH AND SON, LAND AGENTS, &C.

Waterloo Place, Pall Mall, February 16, 1854.

We beg to state that the first proposed scale, of 24 inches to the mile for rural, and 10 feet for town districts, would, we think, be *fully large*, and answer perhaps all the desired objects ; but, looking to the subject merely as land agents and surveyors (unless any larger scale would make the maps too cumbersome, or the extra expense too objectionably heavy), we should be inclined to recommend, in preference, the scale of 3 chains to the inch, (or $26\frac{2}{3}$ inches to the mile), particularly as the majority of enclosure, tithe, and private maps for many years past have been made on this scale, and reciprocal advantages *might accrue* by its adoption ; as some of these maps, properly tested, might be found useful, or hereafter, in case of a comparative or other reference to them, or of improving such older maps considerable expense and trouble might possibly be saved. No particular advantages occur to us at present in the proportional linear scale, and the frequent fractions might sometimes cause confusion.

We should have thought a much less scale than 10 feet to the mile sufficient for the town districts except perhaps where comprehending a city or county town, a large manufacturing or garrison town, or a seaport.

No. 48.

MR. GEORGE H. HUSSEY, LAND SURVEYOR &C.

Green Farm, Wycombe, February 16, 1854.

I should be disposed to recommend No. 2, as I find this scale the best for all purposes connected with the management of estates and properties ; and of No. 3, I do not consider I am qualified to express an opinion. I have never seen a plan drawn on that scale. I think some practical inconvenience might arise from the adoption of No. 3, as it would be a different scale from any of the plans that have been made for public purposes, such as Tithe Commutation, Parochial Assessments, &c.

As I am principally engaged in the management of estates, I have generally found, in any questions of boundaries or quantities, the 3 chains to the inch the best scale.

Replies in favour
of the 26 $\frac{3}{4}$ inches
and ten-foot scales

No 49.

MR. JOHN FOWLER, CIVIL ENGINEER.

2, Queen Square Place, Westminster,
February 15, 1854.

I have much pleasure in complying with the request conveyed in your communication, dated January 16th, on the subject of the Ordnance Survey.

The three scales submitted for choice are so nearly alike in their respective proportions to the ground, that it may be assumed the question is narrowed to the consideration of the most convenient method of dealing with the fractional proportions.

The different methods may be stated as follows:—

- 1st. A definite number of inches to a mile.
- 2d. A definite number of chains to an inch.
- 3d. A definite fractional proportion.

The two principal uses to which a plan drawn at any of these scales could be applied (omitting for the present the enlarged plans) would be:

- 1st. A lineal or distance measurement.
- 2d. Superficial area computation.

I do not think that any important difference would be found between any of the scales in ascertaining distances merely, because the operation is so simple, and the calculation so easy, to obtain quantities in miles, chains, yards, feet or otherwise, that in this respect they may almost be treated as practically equal in convenience.

With regard, however, to ascertaining superficial areas (and this I believe would be the most valuable use to which a plan of this scale would be applied), a very important difference would be experienced, and for the following reasons:

The Tithe Commutation plans having been fixed at three chains in an inch, numerous other plans, to which a similar scale would be applicable, have likewise been made at three chains in an inch, so that it has become a kind of standard scale for rural districts.

The majority of plans requiring smaller or larger scales have also, for convenience, been made proportions of three chains in an inch.

For instance, six chains in an inch for Parliamentary plans is the most useful and convenient size for ordinary works, or 12 chains (with enlarged plans) for extensive and simple works; whilst for suburban or populous districts a scale of three chains is generally used.

In consequence of this general practice all surveyors, land agents, and numerous other persons are provided with instruments adapted to take measurements and computations from these scales, and therefore a fractional departure from a scale of three chains to an inch would be attended with serious inconvenience and confusion.

I see no possible advantage in any way in the first method (or 24 inches to a mile) over the second (or three chains to an inch); and as chains to an inch is the usual method employed and the most convenient, there seems no reason for adopting the first method.

With regard to the third method, or definite fractional proportion, with which I happen to be familiar, from having used it in French plans and sections, I would remark that, provided the question for consideration was whether all plans for the future for every official or legal purpose should compulsorily be on this method, I think the decision would demand much consideration; but, as I understand the question to be simply as to another Ordnance map, which, although undoubtedly important, is still only one of very many others, I have no hesitation in giving my opinion against its adoption.

With respect to the enlarged plan, it is manifest that as we have Ordnance maps at five feet to a mile already, it would be inconvenient to have an irregular proportion of five feet, as proposed by the third method, instead of ten feet, as proposed by the first and second methods.

Replies in favour
of the $26\frac{3}{4}$ inches
and ten-foot scales.

I am of opinion that, of the three scales submitted for choice, the second or three chains to the inch is, under all the circumstances, decidedly the best, and that its non-adoption would be attended with great practical inconvenience.

The questions put to me are confined to the mode of dealing with the fractional proportions of an assumed scale, and I have answered the questions in the terms in which they were put; but I feel it necessary (to prevent myself being misunderstood) to give my opinion of the scales which would be most useful to be adopted for the future in Ordnance maps:—

1st. And before all others, one inch to a mile for every part of England, Wales, Scotland and Ireland.

2d. And subsequently, eight or ten chains to an inch, beginning with towns and the most populous districts.

I think a scale of three chains to an inch is a mistake altogether, because the extent of its applicability and usefulness would be very limited from this fact, that, except for private purposes, it would be inconvenient and rarely applicable, and for most private purposes it would be rather too large or too small, and, unless almost annually checked, and if not infallibly correct, would never be received as authority.

I consider a scale of ten feet to a mile unnecessarily large for any ordinary purpose, and would generally require reducing to a smaller scale in order to be more convenient for use, although in some few special cases it would not be even large enough; but in every case these excessively large scales are nearly useless, from the changes which are so constantly taking place, and the necessity of using special scales, and making special surveys in all cases, where such a scale might be expected to be used.

No. 50.

MR. CHARLES F. CHEFFINS, LAND SURVEYOR, &c.

Southampton Buildings, Chancery Lane,
February 17, 1854.

In reply to your letter of the 16th ult., in reference to the *proper scales for the Ordnance Survey*, I beg to state that, although I do not approve of either of the proposed scales, I prefer the *second* proposition as the one most likely to be useful, viz., three chains to the inch for rural, and ten feet to the mile for town districts, inasmuch as many first-class maps of parishes have been made to a scale of three chains per inch, under the Tithe Commutation Act, and this scale is found to be quite large enough for all practical purposes; indeed, it is the scale I have generally adopted for setting out the line, and calculating the quantity of land in the construction of railways, docks, &c.; I also consider that ten feet to the mile for towns is large enough to show every detail, and to lay out works for drainage, sewers, waterworks, &c.

I fear that if the third proposition was adopted simply for the Ordnance Survey, it would lead to much inconvenience, as it would not accord with the scales in ordinary use, and uniformity in such matters is of great importance. I certainly would not recommend these scales for adoption.

In conclusion, I beg to remark that I consider it very desirable to continue the scale of six inches to a mile, for rural districts, (to which the northern counties of England, and the whole of Ireland are already published by the Board of Ordnance), for I am convinced that this scale would be the most popular, and answer general purposes; and I have found that the larger the scale the more difficult it is to join the sheets, which would be required in almost every case, if the three-chain scale be adopted, from the small portion of country contained in an ordinary sheet. On the whole, therefore, I would recommend the six-inch scale for rural districts, and ten feet to the mile for towns, to be adopted by the Board of Ordnance.

No. 51.

MR. PERCY W. BRACKENBURY, LAND SURVEYOR, &c.

Wellow House, Newark, February 20, 1854.

In reply to your Lordships' communication respecting the scales to be used for Ordnance maps, I have the honour to inform your Lordships that I consider

the scales of three chains to an inch for rural, and ten feet to a mile for town districts, sufficiently large to comprehend all objects for which surveys and plans are usually made, and are the scales I have almost invariably adopted.

Replies in favour
of the $26\frac{3}{8}$ inches
and ten-foot scales.

The decimal scales would, I believe, be found most inconvenient.

No. 52.

THE DUKE OF DEVONSHIRE.

Devonshire House, February 18, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th ult., requesting, for the Lords Commissioners of the Treasury, my opinion as to the scales to be adopted for the Ordnance Survey.

In reply, I have to inform you that I find very great difference of opinion to exist with respect to the merits of the different scales mentioned in your letter.

Upon consideration of the various opinions which I have received, I recommend that the scale of three chains to the inch for rural districts, and ten feet for town districts, should be adopted.

The decimal scales would be attended with some advantages, but not in my opinion sufficient to compensate for the practical inconvenience which would arise from the adoption of these scales.

No. 53.

MR. JOSEPH LOCKE, M.P.

London, 13, Duke Street, Westminster,

February 20, 1854.

I have had the honour to receive your communication of the 16th ult., on the subject of scales to be employed in laying down the Ordnance Surveys, but you do not state whether the maps are for publication or for general reference.

On referring to my letter of the 3d May last on this subject, which was written conjointly with Mr. Brunel and Mr. Robert Stephenson, you will find an opinion there expressed in favour of the one-inch scale for publication; and that for all purposes, such as I presume to be contemplated by you in your letter, a scale of "*about 20 inches to a mile*" was that which we then recommended.

So long as the present standards of measures continue in use, such as the chain, foot, and inch, I think it would be desirable, for maps for general reference, to lay them down on such scales as would admit of the application of those standards with the greatest facility. This view would lead me to avoid, where practicable, all fractional parts of those standards, and our former recommendation of a 20-inch to the mile scale, (which is four chains to an inch) is not inconsistent with that view.

The two propositions you make, viz., the first and second, have not this advantage; for the former, which is 24 inches to the mile, is $9\frac{3}{8}$ chains to an inch; and the second, of three chains to an inch, is $26\frac{3}{8}$ inches to a mile.

I do not mean to say that these fractions are seriously objectionable, but if the 20-inch to a mile scale were in other respects equally applicable, I should prefer it to either of the scales you propose. But if, for any reason unknown to me, you require to use one or other of these scales, I think the second, or three chains to an inch scale, is preferable.

Your question having reference to scales bearing a definite numerical proportion of the linear measurement of the ground, is one of considerable importance, and the introduction of such a system would, I think, be attended with great inconvenience; and, unless the whole system of measures were changed, I should not feel disposed to recommend its adoption.

I have had occasion, for many years, to use maps (in France) drawn on that system, and I have no hesitation in saying that it does not offer to my mind any advantage which is not obtained by the system of scales employed in England; and up to this moment I feel I have a clearer conception, when examining maps on English scales, both of distance and of area, than I have yet been able to obtain from a careful consideration of a French map. In examining a map plotted on either system it would be generally necessary to reduce mentally,

Replies in favour
of the $26\frac{2}{3}$ inches
and ten-feet scales.

the scale of the map to some well-known standard which the mind could grasp, such as an inch, or a metre; and it so happens that the convenient sizes of maps are those which more generally admit of the ready application of the smaller standard than of the large one, and thus the difficulty of having mentally to divide the metre is avoided.

No. 54.

MR. WILLIAM PRICE, LAND SURVEYOR, &c.

Benhall, Ross, Herefordshire, February 21, 1854.

On a careful examination of the three scales submitted for my opinion, I consider that the second scale described in your circular is the most preferable, inasmuch as the late Tithe Commutation Surveys and Maps were generally made on a three-chain scale, and it would be an easy mode of comparing the accuracy of the new and old surveys, if they were to approximate as nearly as possible in their scale of measurement.

I am satisfied that three chains to the inch for rural, and 44 feet to the inch for town districts would be the most practically useful for all purposes.

No. 55.

MR. JAMES SIMPSON, CIVIL ENGINEER.

29, Great George Street, Westminster, February 24, 1854.

With reference to your communication upon the subject of the Ordnance Survey, I have the honour to inform you, for the information of the Lords Commissioners of Her Majesty's Treasury, that I have considered the propositions of the scales to be adopted for surveys and plans, and am of opinion that a scale of three chains to the inch for rural districts will be found more generally applicable and useful than the scale of 24 inches to the mile, three chains to the inch being a scale most frequently used in this country for plans of estates, parishes, &c. &c.

With respect to a scale of 10 feet to the mile for town district plans, such a proposition I consider should not be adopted, as it would lead to the introduction of plans of most unwieldy dimensions, and to difficulties and inconveniences which already cause great obstruction and annoyance to engineers, surveyors, and other persons interested in such matters. I may also add, that so far as my experience leads me, plans of these dimensions will be found expensive; and considering how seldom I make use of large plans of the kind, I do not recommend the scale of 10 feet to the mile for town district plans.

As regards scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped, no particular objection occurs to me to these scales, but I do not believe that practical advantages of any great importance for civil purposes will result from the adoption of the recommendations of the Statistical Society of London and the Statistical Conference at Brussels.

The requirements as to scales for surveys and plans certainly are, greater uniformity and the general introduction of a decimal system of division; but even these, in my humble opinion, have their limits, as necessity and expediency will, in spite of the most rigid rules, occasionally compel the use of other divisions in particular cases; and present practitioners will, for a long period of time after the application of a more general and uniform decimal system, have to contend with all the difficulties and inconveniences which will be found inseparable from the change to and introduction of it.

No. 56.

MR. A. SMOLLETT, M.P.

House of Commons, February 24, 1854.

I have had the honour to receive your circular letter of the 16th January, in reference to the proper scales to be adopted for the Ordnance maps.

In the answer which I returned in May last to the previous communication on this subject from the Lords Commissioners of Her Majesty's Treasury, I stated it as my opinion that a scale of 24 inches to the mile for the draft plans of rural districts, and of 120 inches to the mile for the draft plans of towns, was the smallest which could with any safety be relied on for computing the contents of fields and other minute parcels and subdivisions of property.

Replies in favour
of the $26\frac{2}{3}$ -inches
and ten-feet scales.

Since that time I have had frequent opportunities of hearing the subject discussed by surveyors and professional men of the highest eminence, and while they concur with me in the opinion I have expressed as to the minimum scale on which a national survey should be made, I find a large majority of them consider that, on the whole, the second, or three chains to the inch scale, is that to which they are disposed to give the preference.

In deference, therefore, to their opinions, and having no professional knowledge or experience of my own to give weight to my conclusions, I venture to recommend the above scale, viz., that of three chains to the inch, or $26\frac{2}{3}$ inches to the mile, for rural, and of ten feet for town districts, as the one which ought to be adopted.

No. 57.

MR. J. P. LOFTHOUSE, LAND SURVEYOR, &c.

9, Great College Street, Westminster, February 24, 1854.

On the subject of the Ordnance Survey, I should recommend a scale of three chains to the inch for rural districts, and of ten feet for town districts.

I think the adoption of decimal scales would be productive of much practical inconvenience.

No. 58.

MR. WALTER COULSON, Q. C.

5, New Street, Spring Gardens,
February 27, 1854.

In answer to your letter of the 16th ultimo, referring to my former communication on the subject of the Ordnance Survey, and requesting me to inform the Lords Commissioners of Her Majesty's Treasury which of the scales mentioned in that letter I would recommend, (supposing it to be determined that the scale should be sufficiently large to comprehend all the objects for which surveys and plans are usually made,) I have to request you to submit to their Lordships that my opinion is in favour of the second scales mentioned in your letter, viz., "Three chains to the inch, or $26\frac{2}{3}$ inches to the mile for rural, and " 10 feet for town districts."

My preference of these scales, especially that as to the rural districts, is grounded on the great amount of valuable plans on the same scales now existing of parishes in England, and on the greater facilities which land surveyors are understood to have in working with reference to scales to which they are accustomed.

I conceive the adoption of the decimal scale would be productive of some degree of practical inconvenience, from the large body of surveyors in England being unaccustomed to work on it.

But (though I have before ventured to express a strong opinion to their Lordships on the importance of having the plans sufficiently large) the question as to the comparative advantage of the different plans of nearly the like sufficiency is so much a matter for the consideration of more practical persons, that I submit my opinion on the details with hesitation and diffidence.

No. 59.

PROFESSOR FORBES, PRESIDENT OF THE GEOLOGICAL SOCIETY.

(See No. 36, at page 245.)

Replies in favour
of the 26 $\frac{2}{3}$ -inches
and ten-feet scales.

No. 60.

MR. JOHN BRAVENDER, LAND SURVEYOR, &c.

Cirencester, February 27, 1854.

If it be desired to construct the Ordnance maps on a sufficiently large scale to become of use in case of a national registration of lands and estates, whereby to facilitate sales, and reduce the expense of transfers, I, individually, should much prefer the scale of three chains in an inch to be adopted, and I think such scale will be of greater practical utility than any other for such purpose. It is sufficiently large to show clearly and distinctly every object in agricultural districts, and such as to admit of very accurate planning, plotting, and casting (to ascertain quantities). A smaller scale would not admit of the requisite correctness in those particulars, and a larger scale would be unwieldy and cumbersome without being more accurate.

Accuracy of planning, plotting, and casting may be secured by the use of any of the three scales mentioned in your circular of the 16th January. They do not differ so considerably as to very much affect the work when systematically and accurately laid down by them; but the three-chain scale has been so extensively used, in the construction of the working plans of all the surveyors of any standing in England, that, if other scales were to be adopted, the first class and other accurate three-chain plans of extensive districts would have to be laid aside as useless; but if, on the contrary, a three-chain scale be adopted, all or most of such maps might be incorporated and embodied in the plans to be constructed by the Ordnance surveyors. The three-chain scale will be large enough to distinctly show all moderately sized villages, and very small towns; but the larger towns, &c., will require a larger scale than that of three chains to the inch.

I should think a scale of 10 feet per mile, which is 44 feet in an inch, too small. I have found a scale of 20 feet to the inch to answer well enough for all or most of the purposes for which such plans are usually made. For working plans for draining, &c., I have found 20 feet to the inch answer very well. Should it, however, be anticipated that a general registration of property will take place, I should certainly recommend a larger scale than 44 feet to the inch, as the more suitable to meet the minuteness required by the subdivisions of property in towns when sold for building purposes.

I think the scale of 10 feet to a mile, 44 to an inch, will be large enough for sanitary purposes. I do not think the adoption of the decimal scales (No. 3.) would be any advantage.

Should an universal decimal system be adopted in England, the three-chain scale affords an equal facility with any other. The quantities obtained are in acres and decimals, and all that is required to complete the system, as far as it refers to the quantities of land, is to make a rood represent a tenth part of an acre, and a perch the tenth part of a rood: we should then have 100 perches to an acre, instead of 160, and 10 roods to an acre instead of four, which would much simplify those matters, simple as they appear to be already.

I should recommend the three-chain scale to be used for rural districts, and the scale of 10 feet to the mile for town districts; but would prefer the town districts to be planned on a scale of 20 feet to the inch, provided the adoption of this scale does not so far increase the size of the plans as to render them cumbersome and unmanageable.

No. 61.

MR. THOMAS HUSKINSON, LAND AGENT AND VALUER.

Epperstone, near Southwell, February 27, 1854.

In reply to the inquiry contained in your letter of the 16th of January last, I beg to state that I am of opinion, that for any national survey which shall be sufficiently comprehensive to include all private, parochial, public, and parliamentary purposes, a scale of three chains to the inch for rural, and 10 feet to the mile for town districts, is decidedly the best.

No map can well serve the purposes I have mentioned which does not admit of the area of each individual property being accurately computed from the

map itself; and such areas cannot be accurately estimated on maps drawn to a less scale than three chains to the inch.

Replies in favour
of the 26 $\frac{3}{4}$ -inches
and ten-feet scales.

Nearly all the enclosure maps in the country, all the first-class tithe maps, and a very large proportion of the working plans of every practical surveyor are drawn to a three-chain scale. There is no question relating to surveys on which the practice, and I presume the opinions of surveyors, is more consistent than on this, of the advantage of a three-chain scale for working plans.

With respect to the decimal scale suggested in the circular, I am of opinion that great practical inconvenience would result from its adoption, or from the adoption of any scale in which chains and inches were not at some points conterminous.

The present mode of measuring and plotting land is founded upon a system of decimal notation affording great facility in calculation. The plan suggested would not facilitate calculation, but would create difficulty in comparing new surveys with existing plans, and confusion by introducing new modes and terms without any equivalent advantage.

The scale suggested, $\frac{1}{2500}$, means that the space measured upon the map is to the space measured upon the ground as 1 to 2,500. In a scale of three chains to an inch, the space upon the map is to the space upon the ground as 1 to 2,376.

It appears to me of no importance whether the proportion of the map to the ground be expressed by one number or the other.

If the question had to be considered de novo, apart from existing plans, and existing practice, the plan suggested might be the best; but no advantage can result from its adoption now which in my opinion would balance the manifold inconveniences of a change.

No. 62.

MR. HENRY JAMES CASTLE, LAND SURVEYOR, &c.

7, Chancery Lane, March 1, 1854.

With reference to your circular requesting my opinion as to the comparative advantage of "certain scales proposed to be used in the New Ordnance Survey," I beg to state,—

That in my opinion the best scale for rural districts is three-chains to the inch, and for towns 10 feet to the mile. In lieu of the latter (unless a new lineal unit should be adopted in conformity with the contemplated changes in the "scales and weights" of the country) I should certainly prefer a scale of 45 feet to the inch, or of 10 feet to 1,800 yards.

Should a new lineal unit be adopted, I should certainly prefer that all scales, whether for rural districts or for towns, should be made measures of this unit, viz., that in every case $\frac{a}{b}$ = a whole number.

As to the practical inconvenience of adopting the scale of $\frac{1}{2500}$ and $\frac{1}{300}$, I am not aware of any of such a nature as to constitute a serious objection to their use.

Replies in favour
of the Decimal
Scales.

R E P L I E S

IN FAVOUR OF

Scales bearing a definite numerical proportion to the linear measurement of the ground.

No. 1.

Mr. H. BELLENDEN KER.

Lincoln's Inn, January 17, 1854.

In answer to your letter of the 16th instant, I beg to observe, that in my opinion, the scale mentioned in the third article is preferable to Numbers 1 and 2; and as far as I am able to judge, I do not think the adoption of the decimal scales will be productive of any practical inconvenience. I am, however, bound to state, that I am not in a situation to give any very decided opinion on this point.

No. 2.

Mr. THOMAS SOPWITH, MINERAL SURVEYOR, &c.

Newcastle on Tyne, 18th January 1854.

I have the honour to receive printed inquiries on specified scales of - - 24 inches per mile for rural districts.

26 $\frac{2}{3}$ " "
nearly 25 $\frac{1}{3}$ " "

and of two scales for town districts, viz.: 10 feet per mile, and 10 feet 6 $\frac{2}{3}$ inches per mile.

Any of these scales are sufficiently large, and I have in practice always adhered to scales clearly defined *by the inch*, as of two, three, or four chains to an inch; the latter of which, or 20 inches to a mile, is what I would adopt for any large plan of rural districts.

I consider 11 feet per mile a convenient scale for towns or mines, on account of the relation of forty feet to one inch, or 10 feet to $\frac{1}{4}$ of an inch.

These scales are well understood by workmen and others, accustomed to connect miles and feet with the *inch* as a standard, but in a geographical point of view the decimal proportion between the map and the object represented is preferable; and as national maps are understood to be available for statistical and scientific purposes, rather than as data for technical and local objects, I would say that any practical inconvenience in these latter departments would be more than counterbalanced by the superior definition of a decimal proportion to the actual objects.

I retain the opinion expressed in my former communication, that an active progress of *the one inch engraved map*, accompanied with a *manuscript* record on a large scale of lines, forming distinct spaces of three, four, or more miles area would best meet the public requirements by a speedy completion of such triangulation, or other lines as would present *an exact geographical skeleton* (so to speak), *of the whole of the north of England and Scotland*.

The publication, with access to the manuscript (or it might be engraved) details of each line, would very soon put the Government and the country at large in possession of a sufficiently accurate general map, as private enterprise acting in each considerable district would soon fill up the interior spaces with a near approximation to the truth, and anticipate by many years the slow progress of the actual survey.

Access to such measured lines would enable parishioners or proprietors to have district surveys on any scale they like, and I am strongly impressed with the belief, that though *lines* may be laid down *with extreme accuracy of detail*,

both as to surface objects and also levels, yet if large areas of country are delineated *with contour lines of level*, it must lead to an enormous waste of labour and loss of time, without the accuracy connected with the plan I propose. Replies in favour
of the Decimal
Scales.

I beg respectfully to send by the book post, a work on Isometrical Drawing,* in which are some considerations respecting scales and the collection of a series of national plans; pages 16 to 24, and 51 to 63.

No. 3.

CAPT^{AIN} W. S. MOORSOM CIVIL ENGINEER.17A, Great George Street, Westminster,
January 19, 1854.

In reply to your letter of the 16th instant, referring to scales proposed for the Ordnance Survey, I can have no hesitation in stating, that upon the premises quoted in your letter I would recommend the scales to bear a definite numerical proportion to the linear measurement of the ground to be mapped.

The introduction, and practical adoption of a national or uniform reference or standard scale of this character, would be of great utility for all engineering, surveying, and land-valuing purposes.

With regard to the second part of your letter, relative to the practical inconvenience arising from the adoption of these decimal scales, it is so obvious that this (or any other) transition must always occasion some practical inconvenience, that the question in that shape needed hardly to be asked. But the real question is one of degree and of comparison, and there can be no doubt that the sooner we grapple with the present heterogeneous scales and multifarious standards of computation the better.

I cannot, however, close this, as matter of opinion, without stating my strong view of the utility of the old Ordnance map, the scale of which is one inch to the mile. For general reconnoissance, prior to large works or large operations affecting "country," this scale is too useful to be thrown aside without severe loss to the community; and while the larger decimal scales will be most valuable, I trust the smaller (decimal) scale, and features delineated, will not be abandoned: the possession of both will give to the practical man all he need desire for preliminary information.

No. 4.

MR. E. W. WILMOT, LAND AGENT AND VALUER.

(See No. 2., at p. 251.)

No. 5.

PROFESSOR L. D. B. GORDON, CIVIL ENGINEER.

24, Abingdon Street, Westminster,
January 19, 1854.

In reply to your circular of the 16th instant, I have the honour to state, for the information of the Lords of the Treasury, that, in my opinion, the most rational scale to adopt for the Ordnance Survey is a decimal proportion of the linear measurement of the ground to be mapped.

The scales of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns, are sufficiently large to comprehend all the objects for which surveys and plans are usually made.

The adoption of these decimal scales cannot be attended by any practical inconvenience, but will have the immense practical convenience that distances and areas upon the map will be readily measurable by any scale of any and all Nations.

* Treatise on Isometrical Drawing, by T. Sopwith, F.G.S. London 1838.

No. 6.

The REV. WILLIAM WHEWELL, D.D., Master of Trinity College.

Trinity Lodge, Cambridge, January 19, 1854.

With reference to the inquiry made by you, on the part of the Lords of the Treasury, as to the best of the three scales for maps there enumerated by you, I have to say, that I conceive it must be an advantage that the scale does not depend on any local or conventional unit, as a foot or a chain, but on the dimensions of the ground itself; and on this account I should give a decided preference to the third of the schemes of scales mentioned in your letter.

No 7.

MR. CHARLES BABBAGE.

Dorset Street, Manchester Square,
January 20, 1854.

In compliance with the request of the Lords of Her Majesty's Treasury, to make them acquainted with my opinion respecting the most advantageous of the three scales of measurement for the Ordnance maps; as mentioned in your letter of the 16th January 1854, I have to observe that I prefer the third, viz., that in which

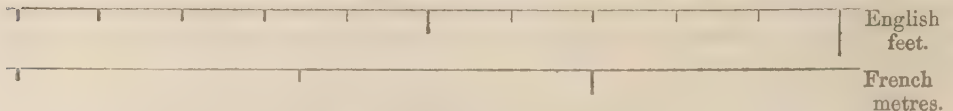
The scale is $\frac{1}{2500}$ for ground mapped for rural districts, and $\frac{1}{500}$ for towns.

Doubtless each country would prefer a scale capable of being expressed in round numbers in its own smaller measures.

But the advantages of having a scale common to all civilized nations, in my opinion, outweighs the admitted inconvenience.

There is one point which I wish to press strongly on their Lordships' attention, whatever scale may be decided upon:—

Every part or single portion of each map ought to have a scale engraved upon it expressing English feet and French metres thus:



If the third plan should be adopted, then the proportionate parts $\frac{1}{2500}$ or $\frac{1}{500}$ ought also to be stated.

Every person who consults such maps may not have a foot rule within his reach, but the scale itself will always be present with the map for whose understanding it is requisite.

A steel roller, having the scale upon it in relief, if once made, would enable that scale to be transferred at the most trifling expense to every copper-plate. I have not sufficient information to state the amount of inconvenience arising from one or other of these scales; but I believe much of that inconvenience will be removed by having its own scale on every portion of each map.

No. 8.

MR. J. MEADOWS WHITE.

10, Whitehall Place, January 20, 1854.

Of the three scales mentioned in your letter of the 16th instant, viz.:

1. A scale of 24 inches to the mile for rural, and 10 feet to the mile for town districts.
2. A scale of 3 chains to the inch, or $26\frac{2}{3}$ inches to the mile for rural, and of 10 feet for town districts, and
3. Scales bearing a numerical proportion to the linear measurement of the ground to be mapped, *i.e.* the scale of $\frac{1}{2500}$ for rural districts and $\frac{1}{500}$ for towns, as recommended by the Statistical Society of London and the Statistical Conference at Brussels, those being the fractions now in general use on the Continent of Europe; and nearly equivalent to the

scales of 2 feet and $1\frac{1}{2}$ inches to the mile for rural districts, and 10 feet $6\frac{3}{4}$ inches to the mile for towns.

Replies in favour
of the Decimal
Scales.

I beg to say that I should recommend the scale referred to in No. 2. in preference to No. 1., conceiving the scale No. 2. superior to any other scale, taking the chain as the unit of measurement, for the reasons stated in my former communication of the 11th May last.

But comparing the scale No. 2 with No. 3, I think the reasons set forth by the Statistical Society of London, and the Statistical Conference of Brussels, undoubtedly give the preference to the scale they recommend.

The suggestion of taking a definite proportion of the actual measured length on the ground, as the representation of that length on the plan, has the additional recommendation of being more simple, and capable of adaptation to any unit which may be used for the measurement, whether of chains, yards, inches, metres, or the like.

The size is, I observe, a medium between the scales Nos. 1 and 2, and hence the advocates of both scales are equally met: and although the fact of so many first-class maps having been made on the scale No. 2, and of that scale being more comprehensive than any other scale in use in the United Kingdom, gives it the preference, yet in an international point of view the assimilation to the Continental scale leads me to coincide with the advocates of scale No. 3.

Further than this, although it is not an adoption of the decimal system as a principle, yet looking at the probability that this system may at no distant period be adopted, the making the Ordnance Survey on this scale will be a considerable step in advance in the event of such an adoption taking place hereafter.

No. 9.

SIR DAVID BREWSTER.

St. Leonard's College, St. Andrews
January 19, 1854.

I am of opinion that the third scale, recommended by the Statistical Conference at Brussels, should be adopted for the Ordnance maps.

As I consider the introduction of the decimal system into our moneys, weights, and measures, to be one of the great reforms which the legislature is expected to bring forward, I of course cannot suppose that the adoption of the decimal scales can be productive of any practical inconvenience.

No. 10.

MR. A. PETERMANN.

9, Charing Cross, London, January 20, 1854

In reply to yours of the 16th instant, I have the honour to inform you, that my opinion corresponds with that of the Statistical Society of London and the Statistical Conference at Brussels, in recommending a scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{3000}$ for towns.

I further beg to state that it appears to me that the adoption of these scales would not be productive of any practical inconvenience.

No. 11.

MR. A. M. DUNLOP, M.P.

Edinburgh, January 20, 1854.

I have been favoured with your circular of the 16th on the subject of the scale of the Ordnance Survey.

I formerly stated an opinion in favour of the 2d scale, and I would still adhere to that opinion if I could not entertain a reasonable hope of a change in our lineal measures so as to make them correspond with the 3d scale; for, however great the advantages of this last scale may be in reference to all communications and comparisons with foreign countries, the main object of the survey ought to be to afford facilities and advantages for local purposes; and this undoubtedly would be best attained by a scale having a definite relation to

our own lineal measures. Trusting, however, that some change will ere long be introduced into our measures, and believing that the adoption of the 3d scale would tend very greatly to promote such change, I feel warranted on the whole in expressing my opinion that the preference ought to be given to that scale.

No. 12.

MR. G. B. GREENOUGH, F.R.S.

Regent's Park, January 21, 1854

I received the favour of your communication dated the 16th instant, transmitting to me, by order of the Lords Commissioners of Her Majesty's Treasury, the several scales which have been recommended to the Government for adoption in the great map of Scotland about to be constructed, and desiring my opinion thereon. In answer, I beg to say, that I give a decided preference to the last of these. The use of national and local scales of distance has been partially throughout the more civilized portion of Europe, and in the course of a few years will no doubt be entirely abandoned.

The terms used in such scales, though once generally employed on the Continent, as well as at home, have, in various countries, and very often in the same country been used to convey different ideas; the term "foot," for example, bears in Europe alone, between 80 and 90 different interpretations at the least; the old national foot of Scotland bears to that of England the ratio of 180 to 181.

The meaning of the term "mile" is in like manner very uncertain. Our English scales of distance are all recognized in Russia and in the United States of America, but, as far as my information goes, by no other foreign state.

The Admiralty Surveyor uses not the Statute mile, but the Italian; so that his measurements of the coast can never coincide with those of the Ordnance Surveyor. On one side the Tweed the distance which the Scotchman marks down as eight miles, when measured by an Englishman on the other side of the river, suddenly becomes nine.

In the more civilized portions of the Continent, local standards of distance have long since been superseded by a natural scale—a first step towards attaining that grand desideratum in geography, as in every other science, the general adoption of a common language. For this reason alone, if there were no other, I should not hesitate to recommend the adoption of scale No. 3, thus avoiding the useless multiplication of local terms, and the employment of arbitrary measures of distance.

I take the liberty of expressing a doubt, rather than an opinion, on the proposal to lay down all town districts upon a uniform scale. There may be good reasons for this which I am not aware of, otherwise this point might, I should think, be safely left to be determined by considerations of convenience, such as would be suggested by the relative importance of these towns, the extent and character of the population, and the complexity or simplicity of the objects to be introduced.

In reply to your inquiry whether the adoption of the decimal scales would be productive of practical inconvenience, I would say, that provided scales, in terms of national measures now in use, were introduced along the margin of the respective sheets, I apprehend no inconvenience whatever.

I notice that in some of the French maps the geographical degree is occasionally divided into 400 parts *vice* 360, a circumstance that may deserve consideration.

Considering the prodigious number of subjects which may be treated in maps and which may all be said to belong to a national survey, I am not satisfied of the expediency of including all in the same net; and cannot rid myself of an apprehension that an attempt to include in one map, or even in one survey, the multifarious objects of mathematical, physical, political, civil, and moral geography, would necessarily lead to confusion. No pains should be spared to provide against this evil, so pernicious, and, I am sorry to add, almost universal.

I feel also some difficulty in recommending the fusion, if I may be allowed that expression, of transient and changeable objects with those which, if not permanent, are at least very enduring.

May I be permitted to add, that a map is, in some respects, analogous to a picture: both should, if perfect, represent only a moment of time; on this

account both are, to a certain degree, unsusceptible of improvements; when unity of time is disregarded, it seems impossible to secure unity of design.

Apologizing for the length of this letter, I am, &c.

Replies in favour
of the Decimal
Scales.

No. 13.

MESSRS. HYDE and Co., LAND SURVEYORS, &c.

(See No. 6, at p. 252.)

No. 14.

LORD WROTTESELEY.

Wrottesley, January 23, 1854.

In reply to your letter of the 16th January, I have to state that I am in favour of the adoption of scale No. 3, *i.e.* $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns; and I do not apprehend that any practical inconvenience will arise from the adoption of decimal scales. In the event of the above suggestion not being adopted, I have further to state that I prefer scale No. 1 to scale No. 2, as being a multiple of scales already adopted.

No. 15.

SOCIETY FOR PROMOTING THE AMENDMENT OF THE LAW.

21, Regent Street, January 23, 1854.

We have the honour to acknowledge the communication made by you on the subject of the Ordnance Survey, and on behalf of the Council of the Society for Promoting the Amendment of the Law, we beg to observe, that the scales specified under the heads 1 and 2 are described with reference to inches and feet to the mile, and chains to the inch; and these scales will be practically convenient so long as those units of measure continue in use.

But, looking to the probable introduction of the decimal system of weights and measures into this country at no very distant date, the scales under the third head, which bear a definite numerical proportion to the linear measurement of the ground, should doubtless be preferred, and the practical inconvenience attending the change will be more than compensated by the facility of adapting these new scales to any unit of measure that may be introduced.

We have, &c.,

(Signed) JAMES STEWART, Treasurer.
ARTHUR SYMONDS, Hon. Secretary.

No. 16.

MR. CHARLES VIGNOLES, CIVIL ENGINEER.

21, Duke Street, Westminster, London,
January 24, 1854.

I have to acknowledge the receipt of your circular letter of the 16th instant, inquiring my opinion as to the proper Scale on which the future Ordnance Surveys should be laid down, and I beg to offer the following observations in reply:

Of the three scales selected for consideration the first two are purely conventional; the third is based on natural and scientific principles.

The ordinary mental inquiry upon looking first at any map, is—"In what proportion does it relate to the real space represented?" and no scale can so well, or so universally, answer this involuntary inquiry, as the last of the three scales set forth, and which is happily described as "*bearing a definite numerical proportion to the linear measurement of the ground to be mapped.*"

The proportion on a map between an inch or any of its multiples, and a mile of distance on the ground, was applied to the original Ordnance maps of England, nearly sixty years since, the first plottings being on a scale of two inches to the mile, and the maps being published on that of one inch to one mile.

This application of the proportion of inch to mile, for the Ordnance maps of Ireland, viz., six inches to the mile for rural districts, and sixty inches to the mile for towns, has no doubt made this scale better known, and the remarkable accuracy and beauty of the maps has led to a vast extension of their use, and to a perfect appreciation of their utility; but this scale is none the less merely conventional, for adopted, from habit and tradition, by the officers of the Ordnance Surveys, its use may be said to be confined practically to that department, and most undoubtedly is so for all the larger scales; and excepting that the scale of one inch to a mile has become familiar to the public for county maps, there is nothing remarkable or commendable in this description of scale (1 to 63,360 or $\frac{1}{63360}$, or decimally $\cdot000015782$) which would not have been equally well, indeed much better, obtained by the simpler proportionate scale of 1 to 50,000, or $\cdot00002$.

So soon, however, as the scale of the map becomes so enlarged as that agrarian measures of small area are required to be expressed or determined, the conventional scale, adapted, it may be, for county, topographical, and military maps, whatever might previously be argued in its favour, ceases to maintain its pretensions, as it ceases to maintain the aliquot proportion to, or to be a multiple of the surveyor's scale,—which, in its turn, is claimed to be, by conventional usage, the best adapted for plans on a scale sufficiently large to be termed *cadastral*.

The adoption of a scale of twenty-four inches to a mile would raise as many objections from surveyors, on account of alleged inconvenience in its practical application to land mensuration, as a scale of 1 to 2500, or $25\frac{1}{2}$ inches to a mile.

When the Government appear, most wisely, to have determined on carrying out the new surveys by the Ordnance on the large scale, so peculiarly well suited for comprehending all the objects for which surveys and plans are usually made, and especially for future statistical purposes, it would seem to be absolutely retrograding in science to adopt either of the two conventional scales. That of twenty-four inches to the mile is so far objected to by the land surveyor as that it represents the awkward proportion of 1 inch to $3\frac{1}{2}$ chains, while the scale of three chains to one inch (a surveyor's very *beau-ideal* of a scale for rural maps) is still more objectionable to the English military topographer, who has accustomed himself to consider multiples of feet, or of inches, as the best proportions on paper to represent miles of ground.

But men of science, not being topographers or engineers wedded to their own systems, and educated persons accustomed to refer to maps, and not being professional men, can attach no value to any conventional proportions, though they will fully appreciate the importance and simplicity of “scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped.”

Such scales are based (as I have before remarked) upon a natural and mathematical principle; they are intelligible to all persons of all nations; they have been adopted in every other part of Europe, and are thus, as it were, cosmopolitan. Be the map Russian or Spanish, Dutch or Italian, French or German, every native of each country understands the scales of the maps of all the others, as readily as he does the degrees of latitude and longitude thereon, without the perplexing process of finding out, on a Russian map, the proportion of a “verschock” to a “werst”; or, on a German map, the proportions of the many different lengths of their feet, and divisions thereof, to the equally numerous different lengths of their miles and leagues.

The necessity of some such natural and mathematical scale for maps was felt on the Continent, and the want was supplied, even before the introduction of the decimal system, and may be said to have been the precursor of that system in France; a system, of which, after a lapse of so many years of its practical benefit in other countries, the English nation are just beginning to appreciate the importance.

While, therefore, so fair an opportunity presents itself of laying the foundation for introducing, at some future time, the decimal system of mensuration, by the application of this principle to the scale of the Ordnance maps, there should be no hesitation in at once adopting it.

Replies in favour
of the Decimal
Scales.

With respect to any practical inconvenience in the adoption of this system of decimal scale, I am decidedly of opinion that there cannot arise any such which will not be easily remedied. The only persons likely to complain are the surveyors and engineers, who have been in the habit of using scales with the inch divided—(say) into 30 parts, representing 3 chains, or 300 links, or 198 feet: and the foot, consequently, divided into 360 such parts, representing 36 chains, or 3,600 links, or 2,376 feet, being their present usual scale, (within the category of those scales in question,) on which they have been in the habit of plotting their surveys of rural districts,—or, of the scale with the inch divided into 40 parts, representing as many feet, and the foot, consequently, divided into 480 parts or feet, being their usual scale for plotting town surveys, to show the smallest buildings clearly.

The above two scales are in the inconvenient proportions of 1 to 2,376, or $\frac{1}{2376}$, or decimally .0004208; and of 1 in 480, or $\frac{1}{480}$, or decimally .00208333, instead of the simple, natural, and mathematical scales of 1 in 2,500, or $\frac{1}{2500}$, or decimally .0004; and 1 in 500, or $\frac{1}{500}$, or decimally .002.

Now the only practical objection to be advanced thereon is, that there are at present, no scales in use in such proportions, or with such divisions of the foot and of the inch. This is quite true,—but the moment it shall be decided that all the future Ordnance maps are to be published on the decimal scale of 1 in 2,500 for rural districts, and of 1 in 500 for towns, every scalemaker in the country will prepare to make such scales, and every surveyor, and especially every engineer, to use them. The foot will be divided into as many parts as will represent 2,500 feet, or 3,788 links, on scales for plotting surveys of rural districts; and for the plotting of town surveys, the foot will have 500 divisions, representing feet.

When the Ordnance Surveys of Ireland first appeared, nearly twenty years ago, scales of feet and of links were made to correspond with the adopted scale of six inches to the mile; the same scale being also applicable to the town maps, on the scale of 60 inches to the mile. I have still these scales in application to the Ordnance maps as now published,—and a change of scale in that map will be followed by a change in the scales made at present.

With this single exception of a change in the divisions, of a foot or of an inch, for the plotting and off-set scales, I am not aware of any practical inconvenience which can arise from the adoption of the decimal scales for the Ordnance maps of the kingdom, whether in the proportion of 1 in 500, or of 1 in 50,000.

In conclusion, I consider it as necessary to adopt the decimal scales for the national surveys, in order to assimilate our maps to those of the rest of Europe, as it is to adopt the new style in the calendar, or to measure degrees of latitude from the equator.

No 17.

ASTRONOMER ROYAL AND PRESIDENT OF THE ROYAL ASTRONOMICAL SOCIETY.

Royal Observatory, Greenwich, January 21, 1854.

I have the honour to acknowledge your letters of the 16th inst., addressed to me as Astronomer Royal and President of the Royal Astronomical Society, requesting my answer to certain questions relating to the Ordnance Survey. I have the honour to offer the following reply.

2. I will commence with laying down what I conceive to be the correct general principles upon which the decision as to the proportion-scale of every map ought to be based. The consideration of these will include the answer to your general question on the merits of the decimal scale, and will also indicate with sufficient clearness, in each individual case, the special merits or demerits of different proportion-scales in reference to that case.

3. The only immediate convenience (so far as I can perceive) of adhering to a scale expressible by any definite proportion (decimal or otherwise) is this,

that when we measure a distance upon the map, we can with facility infer from it the real geographical distance which it represents. Upon the degree of this facility will depend the convenience of the map in daily use.

4. But there is an indirect and collateral effect, of the adoption of a proportion, that refers one denomination of measure upon the earth to another denomination of measure upon the map, which may be of great importance for good or for bad, especially in the instance of an authorised national map. The denomination of terrestrial measure thus habitually impressed upon the minds of all persons who make use of the national map, becomes fixed in our system of measures beyond all power of removal. And it might easily happen, that an injudicious selection of the proportion-scales in the proposed maps would fix upon the general usages of the country, for many centuries, some inconvenient parts of our present system whose use is, at this time, confined to some very restricted applications.

5. Reverting now to the measures upon the map to which allusion is made in paragraph 3., it appears that such measures may be taken in the three following ways:—

(A.) By measuring a distance upon the map, by means of a graduated tape, or a long graduated scale.

(B.) By applying compasses to the two points upon the map whose distance is required, and then transferring the compasses to one of the graduated lines upon the ordinary mathematical instruments.

(C.) By applying compasses, as in (B.), and then transferring them to a graduated line engraved upon the map itself.

6. In considering method (A.), it is to be remarked that the denomination of measure used upon the earth will not, in general, be the same as that used upon the map. Measuring tapes and long scales are commonly divided into inches, and (so indelibly does the inch appear to be fixed in our habits) it is probable that they will (for a very long time at least) continue to be divided into inches. But we never desire to estimate a geographical distance in inches. Any argument for a decimal proportion-scale based upon the supposed universal facility of multiplying a measured map-distance by a decimal number is, as I conceive, without sufficient foundation. I have, myself, constructed maps of the Royal Observatory, its buildings, and its grounds; but I have not made its linear measures $\frac{1}{100}$ part of the terrestrial measures. I considered that it was convenient to adopt the foot as the unit of terrestrial measure, and to use the inch of measuring tapes &c., for the map; I therefore adopted the scale of ten feet to the inch, or $\frac{1}{120}$, and with this proportion I measure every distance with great ease.

7. In method (B.), the same considerations apply, but with far greater variety of application, because there are usually several different lines of graduation upon the same mathematical instrument. They are, in most cases, the following:—

$\frac{1}{10}$ inch, $\frac{1}{20}$, $\frac{1}{40}$, carefully divided.

$\frac{1}{15}$ inch, $\frac{1}{30}$, $\frac{1}{60}$, $\frac{1}{90}$, less carefully divided.

(Sometimes) $\frac{1}{12}$ inch, $\frac{1}{24}$, $\frac{1}{48}$, &c.

(Usually in an obscure part of the scale) $\frac{1}{100}$ foot.

There can be no doubt that the decimal divisions of the inch are the favourites with the public, and that the $\frac{1}{10}$, $\frac{1}{20}$, $\frac{1}{40}$, are specially preferred.

8. Method (C.) can in all cases be used as a last resource. It may even be used concurrently with methods (A) and (B), some familiar denomination being used with method (A) or (B), and some less familiar denomination being engraved on the map, to be used with method (C).

9. I shall now apply these considerations to the town survey. And here I assume that, for the frontages of houses and similar measures, we wish to ascertain and express all our measures in feet. But it is convenient to take the measures from the map in some of the portions of the inch or foot mentioned in paragraph 7. Remarking that a scale not differing much from $\frac{1}{500}$ is desired, (which will give maps of convenient magnitude,) I should class the applicable proportion-scales in this order:

(D.) Practical surveyors will prefer the proportion of $\frac{1}{480}$, or 40 feet to an inch, because it is measured by the most convenient scale upon their instrument

- (E.) I should prefer the proportion of $\frac{1}{600}$ or 50 feet to an inch, or 2 yards to $\frac{1}{100}$ foot, because it is measured without great inconvenience either by the $\frac{1}{10}$ inch graduation, or by the $\frac{1}{100}$ foot graduation; because it is a decimal subdivision (which, *cæteris paribus*, I should be glad to retain), and because it will associate well with a rural scale to be mentioned below.
- (F.) I do not approve of the proportion $\frac{1}{500}$. It makes the use of an inch scale impracticable.
- (G.) The proportion $\frac{1}{328}$ or one mile to 10 feet appears to me to have no recommendation whatever. We do not want miles in measuring the front of a house or the length of a court yard, and this proportion does not even pretend to possess any other convenience.

10. I shall now advert to the rural map. The decision upon the scale to be employed here is very grave and difficult, for the following reason. On this decision will depend the positive maintenance of our existing system of anomalous relations between long and short measures (the most anomalous in the world), or the possible substitution of a simpler system. If the proportion founded on chains is adopted in our national maps, the 11-multiple system is fastened on us for ever. On the other hand, the proportion-scale to be adopted for rural maps ought to be selected with reference to land measure, because, for one application of these maps to itinerary or other measures, they will probably be used fifty times for the measure of fields. I must repeat, that on this decision will depend the decision on a still graver question.

11. If the rural maps are constructed (which I hope they will *not* be) with reference to the chain as the geographical unit, I cannot approve of the suggested scale of 3 chains to the inch. A scale of four chains to the inch would be greatly preferable; first, because the mile is then represented by a very convenient integral number of inches (20); secondly, because the graduation employed will be the very convenient one of $\frac{1}{40}$ inch. But I will not further dwell upon the modifications of a hypothesis, which I trust will not become real.

12. In my opinion, it will be far better to determine the proportion-scale of the rural maps without reference to the chain, and to engrave the scale of chains upon every sheet of the maps for use, when required, by the method (c), paragraph 5.

13. Considering, then, the rural maps without reference to the chain, I should state my opinion on the scales which present themselves for consideration as follows:

(H.) The proportion $\frac{1}{2500}$ is not convenient. It does not give a convenient measure as represented by 1 inch on the map; I do not see that it claims any convenience whatever.

(I.) The proportion $\frac{1}{3000}$ is convenient; the equivalent for an inch is 250 feet; the equivalent for $\frac{1}{100}$ foot is 10 yards; the equivalent for 2 feet is one nautical mile of 2000 yards, or (very approximately) one minute of latitude. The scale is $\frac{1}{3}$ th of (E), which I have recommended for the town map.

14. In recapitulation, I recommend that the proportion-scales to be adopted be those which I have marked (E) and (I), namely:

For the town maps $\frac{1}{600}$ $\left\{ \begin{array}{l} 50 \text{ feet to an inch} \\ \text{or} \\ 200 \text{ yards to a foot.} \end{array} \right\}$

For the rural maps $\frac{1}{3000}$ $\left\{ \begin{array}{l} 250 \text{ feet to an inch,} \\ \text{or} \\ 1000 \text{ yards to a foot.} \end{array} \right\}$

15. I trust that I have adverted with sufficient fulness to all the subjects of your letter of January 16, but I shall, with pleasure, explain myself at greater length if it appear necessary.

Royal Observatory, Greenwich, January 23, 1854.

In supplement to my letter of the 21st inst., I request permission to point out the circumstances which made it desirable that the countries represented at the Brussels Statistical Conference should adopt for their maps the proportion scales $\frac{1}{500}$ and $\frac{1}{2500}$, while in England it is desirable that the proportion-scales adopted should be $\frac{1}{600}$ and $\frac{1}{3000}$.

2. In the Continental States the system is for the most part metrical; the centesimal and millesimal divisions are recognized by the law, and are exten-

sively adopted in practice, and there is no similarly recognized duodecimal division to interfere with the decimal division. In consequence of this, it is a matter of great convenience to all classes that the proportion-scales of the maps should be very closely related to the decimal scale, and the proportions $\frac{1}{800}$ and $\frac{1}{2500}$ answer well to this condition.

3. But in England there is no recognized decimal scale, and the strong tendency among all classes is to make the first descent from the foot by a duodecimal division, namely, to the inch, but then to proceed by decimal scale. The consequence is, that it is desirable that the proportion-scale should be formed on the same considerations as for the Continental States, using the division 12 once instead of the division 10, and thus the proportions $\frac{1}{800}$ and $\frac{1}{3000}$ which I have proposed for England correspond exactly to $\frac{1}{800}$ and $\frac{1}{2500}$ for the Continent.

There is an additional reason in England for this scale which has no analogue either for it or against it on the Continent, namely, that the first rise of measures from the English foot is to the English yard, the proportion being that of 1 to 3. It will be seen from instances mentioned in my letter of the 21st, paragraph 9 (E), and paragraph 13 (1), that this circumstance makes the same proportion-scales convenient both for the yard and for the foot, provided that the denominator of the proportion-fraction is divisible by 3, and this condition is secured by the use of the scales $\frac{1}{800}$ and $\frac{1}{3000}$.

(Signed) G. B. AIRY.

No. 18.

MR. CARLETON BAYNES, CIVIL ENGINEER.

Institution of Civil Engineers,

Great George Street, January 23, 1854.

I beg to acknowledge the receipt of your letter of the 16th instant, requesting, by command of the Lords Commissioners of Her Majesty's Treasury, that I will state which of the three scales therein mentioned I would recommend, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made; and in reply I beg leave to say that, in providing for any future national survey, I would adopt a scale bearing a definite numerical proportion to the linear measurement of the ground to be mapped, *i.e.* the scale of $\frac{1}{2500}$ for rural, and $\frac{1}{800}$ for town districts; for, although as long as the duodecimal system of measurement continues, the scales of twenty-four inches, and of ten feet to the mile, have considerable advantages over them, yet, as I believe that in a very few years we shall see the unit of linear measurement changed, and a decimal system adopted, I beg to recommend the third scale you mention; because, if you have a definite numerical proportion between the map and the linear measurement of the ground, no change in the unit or system of measurement can affect the practical uses of the survey, and if you adopt a similar scale to that now in use on the Continent of Europe, you afford a great facility for comparing the map of this country with the national maps of the other countries of Europe, and the great engineering works of the Continent with those of England.

Referring to the last clause of your letter, I beg to say that, as long as the inch and the mile continue, in their present form, the respective units of calculation on the map and the ground, there will be much extra labour due to the proportion between them being expressed by an interminable decimal; also in comparing measurements on this new map, and on the existing maps of this country, two distinct scales must always be used; but on the other hand, if measurements on this map are to be compared with those on other national maps of Europe, two scales will no longer be necessary, and a corresponding amount of labour will be saved.

During the transition from a duodecimal to a decimal system of scales, much practical inconvenience will doubtless be experienced, but the establishment of the decimal system will produce such a saving of time in calculations, as will, I believe, far more than compensate for it.

No. 19.

SIR JOHN HERSCHEL, BART., F.R.S.

Harley Street, January 21, 1852.

The three scales for the enlarged maps of the Ordnance Survey for rural districts, of which in your circular of the 16th you desire me to state which I should prefer to see adopted, may be thus brought into comparison:—

1. Twenty-four inches to the mile. The only recommendation of this scale is the apparent simplicity of its statement, when expressed as two feet to the mile. But this is merely apparent. The mile has reference rather to the yard than to the foot. A map constructed on this scale cannot be available read off by an ordinary foot-rule, divided as usual into inches, and eighths or tenths. A special scale in which the foot is divided into forty parts corresponding to chains is required, so that this scale has reference to the chain; and, for any measurement required to be known in yards, a division by 22 is needed. Expressed in fractions of the natural dimensions, this scale corresponds to $\frac{1}{2640}$, a cumbersome and inconvenient division.

2. $26\frac{2}{3}$ inches to the mile. This also has reference to the land chain, and a more simple one than No. 1. and on this account, as well as from its having been extensively used in the parish surveys of the Tithe Commission, is preferable to No. 1. Like that, however, it cannot be read off in yards on the ordinary foot-rule, and such a rule must have its inches specially divided into thirtieths to read it off in chains and decimals. Rules so divided are not common except in the hands of surveyors. Expressed in fractions of the natural dimension, this scale corresponds to $\frac{1}{2376}$, again a cumbersome and inconvenient division.

Both these scales having reference to the chain, should that measure become disused or restricted in its use, they would lose much of their advantage. Should an itinerary measure of 2,000 yards come to be substituted for the present mile, these scales would no longer bear any simple reference to ordinary measures of linear distance, and maps constructed on them would be purely agrarian. This change forms one of the recommendations of the Commission for the restoration of the lost standards of weight and measure in their Report of 1841, and it may very reasonably be expected that it will be still more strongly dwelt on in their forthcoming and final Report, now in preparation.

3. Scale of $\frac{1}{2500}$ of the natural linear size. This scale has the advantage that it may be read off in the measure of any country, or in any units of measure, on a ruler representing such unit, or one of its usual fractional parts, if too long for a ruler, by a simple multiplication by 2,500., *i.e.* by multiplying by 10,000 and dividing by 4. It is therefore equally available for all nations, and, having no special reference to any conventional unit, is cosmopolitan. On that ground and on its harmony with the decimal system generally, I have no hesitation in giving it my preference. In so doing, however, I ought to observe that having no experience in land surveying, or in the construction of geographical charts, I have had little or no opportunity of forming an opinion on practical or technical grounds.

The scale now under consideration corresponds to 25.344 inches to the mile, and is therefore almost exactly coincident with the arithmetical mean (25.333) between the other two.

The same reasons which decide my preference of the decimal scale in the case of rural maps, apply to those of town districts, in which the choice lies between ten feet ($\frac{1}{528}$) to the mile, and 10.56 feet ($\frac{1}{500}$). In town maps the expression of lengths in feet and yards is of far more consequence than that of surface in acres, so that the chain has less hold on such maps for common reference than in rural ones.

It may be objected to scales of this nature that, being purely abstract, they present to the eye no representation of any known definite length or distance. This, however, is obviated by engraving on the margin or other convenient part of each map (as very commonly practised) divided scales of the chief European linear measures, reduced in the same ratio, such as a scale of English miles, of 1,000 yards, of the French kilometre, the German mile, &c. &c.

I am unable to perceive any practical inconvenience which can result from the adoption of these decimal scales, if this condition be attended to.

No. 20.

MR. RICHARD B. GRANTHAM, F.G.S., CIVIL ENGINEER.

2, Robert Street, Adelphi, January 23, 1854.

I have had the honour to receive the circular from you of the 16th inst., requesting me to inform the Lords Commissioners of Her Majesty's Treasury which of the three scales therein proposed I would recommend to be adopted or the Ordnance Survey, namely:—

1st, a scale of 24 inches to the mile for rural, and of 10 feet to the mile for town districts.

2nd. A scale of three chains to the inch, or 26·66 inches to the mile for rural, and of 10 feet for town districts, or

3rd. Scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped, *i.e.* the scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns.

In my reply to your former circular, dated August 31, 1853, I recommended that the draft plans should be laid down to a scale of 24 inches to the mile for rural, and 120 inches for town districts, and I still consider that those are the most useful scales, and that they would answer every purpose. I very much approve of making the maps bear a numerical proportion to the surface, and recommend that it should be adopted in this case, and the scales I had stated in my former reply are for rural districts $\frac{1}{2640}$, and for towns $\frac{1}{528}$; but the fractions recited in your last circular are very near those dimensions, namely, 25·34 inches for rural, and 126·72 inches for town districts; and as those scales are in general use on the Continent, and as there may arise several advantages from a uniformity of scale at some future time, I would prefer that the proportion $\frac{1}{2500}$ for rural, and $\frac{1}{500}$ for towns should be adopted.

I should also beg to repeat my remark upon the advantages which will be attained by a decimal acreage instead of roods and perches, and I should hope that the adoption of a decimal or numerical proportion of scale to surface may bring about that object, coincident with a decimal coinage.

The fraction of $\frac{1}{2500}$ of linear measurement is very nearly one acre of land to one square inch on the map; namely, '998 acre, and to make it correctly to the fraction it should be $\frac{1}{2504}$.

With reference to the adoption of decimal scales, I do not believe that any inconvenience whatever will be experienced. The scales, whether made of ivory or wood, would be divided into chains and parts of chains, and feet or yards, with equal accuracy to any at present in use. And also, as to the transferring to or comparing the new maps with other maps of different scales, no difficulty would be felt. I am frequently in the habit of working at one time upon plans having the most diversified scales; for instance, architectural and mechanical plans with field surveys and sections, and by practice it is easily accomplished; and so I have no doubt many of the profession are obliged to do,—draughtsmen and assistants very soon acquire the practice.

I must beg here to urge again the suggestion contained in my former reply, that the printed maps should be evidence in courts of law, in arbitrations, and before Parliamentary committees, in the same manner as Acts of Parliament printed by the Queen's printer.

I presume that the same rule for the scales of printed maps will be adhered to, as recommended in my former reply, namely, half the linear measurement of the draft plans for the rural and town districts.

No. 21.

MR. T. SMITH WOOLLEY, LAND AGENT AND VALUER.

Collingham Manor, Newark, January 23, 1854

I have the honour to acknowledge the receipt of your circular of the 16th instant.

I have given the question my best attention and consideration.

Presuming that no alteration will be made in the present principle of surveys and mapping, I am of opinion that the scale of three chains to an inch, or $26\frac{2}{3}$

inches to the mile, would be found the most convenient, as being the scale on which a large proportion of the best maps, including a large proportion of the first-class Tithe maps, has been made.

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If, however, there is any probability that a decimal scale will at any future time be adopted, I should very strongly recommend the adoption of the third scale.

This would occasion some temporary inconvenience; but the principle is in itself so sound, and would admit of application to maps on *any* scale, that I think the inconvenience would bear no proportion to the advantage.

No. 22.

MR. W. MACQUORN RANKINE, CIVIL ENGINEER,
F.R.SS. LOND. AND EDIN.

24, Abingdon Street, Westminster,
January 24, 1854.

I have this morning had the honour of receiving your letter on the subject of the Ordnance Survey, dated the 16th January.

With respect to the question proposed by the Lords Commissioners of Her Majesty's Treasury, whether the scales of the Survey should be in the proportion of certain numbers of inches or feet to one mile, or certain numbers of chains to one inch, or should bear "a definite numerical proportion to the linear measurement of the ground to be mapped, that is, the scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns," I beg leave to make the following observations.

In consequence of the universal employment of a decimal system of numeration amongst civilized nations, the advantages possessed by a decimal system of measures, not merely for scientific purposes, but also in point of practical convenience and economy of time and labour, are so great and so obvious, that there can be little doubt of the adoption, sooner or later, of such a system by every nation.

Chiefly for this reason, but partly also for the sake of the convenience which would arise from the adoption of a uniform, or easily comparable system of scales throughout the world, I consider that scales expressed by exact decimal fractions of the linear dimensions of nature, such for example, as those recommended, viz.: $\frac{1}{2500}$, or $\frac{1}{10000}$, and $\frac{1}{500}$, or $\frac{1}{1000}$, are beyond comparison superior to scales not expressed by exact decimal fractions.

The only practical inconvenience attending the introduction of such a decimal system of scales, would be the necessity for the manufacture and purchase of a number of drawing or measuring scales divided differently from those hitherto made; but this I do not regard as of sufficient importance to be taken into consideration in comparison with the advantages of a decimal system, and the inconvenience which would arise from adopting a different system.

No. 23.

MR. F. O. MARTIN, BARRISTER-AT-LAW, late Fellow of Caius College,
Cambridge.

Stondon Place, Brentwood, January 23, 1854.

In reply to your letter of the 16th instant, I beg to express my decided opinion in favour of the third class of scales therein mentioned.

I am not aware of any practical inconvenience that would result from the adoption of the decimal scale when once the use of it had become familiar.

The scales $\frac{1}{2500}$ and $\frac{1}{500}$ differ from 2 feet $1\frac{1}{3}$ inches and 10 feet $6\frac{2}{3}$ inches to a mile, only by .0107 inches and .0534 respectively, and for common purposes may be considered as the same with them.

MR. ALEXANDER DOULL, CIVIL ENGINEER AND SURVEYOR.

1, Morden Terrace, Greenwich, January 24, 1854.

I beg to acknowledge the receipt of your letter of the 16th inst., in reference to the scales of the Ordnance Survey.

In my former communication upon the subject of the Ordnance Survey of Scotland, I preferred a scale of 24 to a scale of $26\frac{2}{3}$ inches to a mile for rural districts, in consequence of the 24 inch scale being an equal proportion of the one inch for the reduced shaded map, and of the 120 inch map for the towns.

I was aware that a scale of 24 inches to a mile was the minimum scale upon which a map could be constructed to serve all the purposes to which a large scale map can be applied, and that, in order to effect these purposes efficiently on that scale, very accurate measurements in the field, and very neat delineation in the construction of the map, would be necessary.

In reconsidering the subject, in reference to the choice of either of the above scales, or of a scale bearing a definite numerical proportion to the linear measurement of the ground to be mapped, I have no hesitation in giving the preference to the latter; and as $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns, are amply sufficient for the purposes contemplated by these scales, I beg strongly to recommend their adoption. But to carry out this system consistently with itself, it will be necessary to have the reduced map also constructed upon some definite numerical proportion of the linear dimensions of the ground, such, for example, as $\frac{1}{100,000}$, nearly two thirds of the present inch, which would be amply sufficient for the reduced shaded map of Scotland, with the proposed large maps of the rural districts and of the towns, giving all the minute detail that can be required.

I do not apprehend that any greater inconvenience will result from the introduction of the decimal scales than that of rendering the construction of new scales necessary, and this would also be the case if the scale of 24 inches to the mile was adopted, as the scales at present in use among the surveyors have reference to inches and chains, and not to inches and miles.

There can be no doubt but the subject of the introduction of the decimal notation in money, weights, and measures, will very soon force itself upon the attention of Government, and the adoption of the decimal scales above recommended will at least not embarrass the subject, but tend very much to facilitate the introduction of a good decimal system for land measure.

I beg to add the following decimal system of measure, based upon the hundred link chain, which I believe will prove less embarrassing as an initial measure than the foot or the yard. I only venture, however, to send it as a mere suggestion, as I have not had time to investigate the subject fully, but will continue a more extensive examination should you think it desirable to do so.

PROPOSED SYSTEM OF DECIMAL MEASURE, BASED UPON THE CHAIN.

		<i>Linear Measure.</i>	
		NEW.	OLD.
	1 inch	-	= $\frac{99}{125} = \frac{4}{5}$ inch nearly.
10 inches	1 link (or foot)	-	= $\frac{33}{50} = \frac{2}{3}$ foot nearly,
10 links	1 rod	-	= $\frac{2}{3}$ pole, $2\frac{1}{3}$ yards, $6\frac{2}{3}$ foot.
10 rods	1 chain	-	not altered.
10 chains	1 furlong	-	= same length, 10 to 1 mile.
10 furlongs	1 mile	-	= $1\frac{1}{4}$ miles.

		<i>Square Measure.</i>	
	1 square inch	-	= .627264 = ($\frac{2}{3}$ nearly) square inch.
100 square inches	1 square link	-	= .4356 = ($\frac{7}{16}$ nearly) square foot.
100 square links	1 square rod	-	= .16 perch = 4.84 square yard.
100 square rods	1 square chain	-	= 1 square chain $\frac{2}{3}$ rod = 16 perches.
100 square chains	1 square furlong (or acre)	} = 10 acres.	
100 square acres	1 square mile	-	= $1\frac{9}{16}$ square mile (= $1 + \frac{1}{2} + \frac{1}{16}$).

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Scales. ———

Cubic Measure.

1 cubic inch	- =	·496793088 cubic inch ($=\frac{1}{2}$ nearly).
1000 cubic inches 1 cubic link	- =	·287496 cubic foot ($=\frac{1}{4}+\frac{3}{80}$ nearly).
1000 cubic links 1 cubic rod	- =	10·648 cubic yard ($10\frac{2}{3}$ nearly).
1000 cubic rods 1 cubic chain	- =	10648 cubic yards.

No. 25.

LOCAL DIRECTOR OF THE GEOLOGICAL SURVEY OF IRELAND.

Geological Survey Office, Dublin, January 23, 1854.

I have the honour to acknowledge your letter of January 16th, 1854, requesting my opinion as to the comparative convenience of three proposed scales for the publication of the Ordnance maps, and beg leave to reply as follows :

1. The scale of twenty-four inches to the mile has the numerical proportion of $\frac{1}{2880}$ to the linear measurement of the ground to be surveyed, and that of three chains to the inch the proportion of $\frac{1}{2376}$.

2. The scale of ten feet to the mile has the similar proportion of $\frac{1}{528}$. When these fractions are compared with the proposed ones of $\frac{1}{2500}$ and $\frac{1}{500}$, it is obvious that maps on the two latter scales would not sensibly differ from those on the former so far as space for the delineation of the natural or artificial features of the ground is concerned.

If our measures of length and area were decimal ones, the two latter scales would of course facilitate all computations as to distance and content, and would on that account be preferable. Looking to the future introduction of such decimal measures, it would be wise that our great maps should be prepared for them, especially so if at the same time the scales adopted were identical with those largely or generally, or which may be universally, in use on the Continent.

Looking to the present time only, the introduction of those scales would be productive of some inconvenience, since the one is not easily, and the other not at all, exactly commensurable with our linear measures, founded on the inch as a unit, and having twelve and three as multiples. A peculiar set of scales, specially constructed for those maps, would have to be brought into use. How far it would be worth while incurring that inconvenience for the sake of preparing the way for the introduction of decimal measures, and rendering our best maps directly comparable with those of the Continent, are questions which must depend for their answer on the probable nearness of the first event, and the comparative extent or universality of the latter practice, and on these points I have no means of forming an accurate judgment. My own feelings would lead me to put up with the present inconvenience for the sake of the prospective advantage.

I would here beg leave to observe, that I still retain my opinion as to the advisability of completing the publication of the six-inch map of the United Kingdom, uniform with that already published of Ireland and of parts of England and Scotland. I look upon a map of about that scale, say the ten thousandth of nature (six inches to the mile $=\frac{1}{10,560}$) as of very high value for many of the practical, and for nearly all the scientific purposes to which a map can be applied. Lastly, I would remark that if the scales of $\frac{1}{500}$ and $\frac{1}{2500}$ are adopted (and possibly also that of $\frac{1}{10,000}$, or near it), it would seem advisable to alter the scale of the general map from that of one inch to the mile (which $=\frac{1}{63,360}$) to $\frac{1}{100,000}$ or $\frac{1}{50,000}$, in order to make it directly comparable with the larger maps, and serve as their index in addition to its other uses.

(Signed) J. BEETE JUKES.

No. 26.

MR. W. THOMAS COLLARD, LAND SURVEYOR, &c.

Canterbury, January 24, 1854.

In answer to your circular of the 16th of January, I beg to state that, in my opinion, it is most desirable one uniform scale should be adopted for all public surveys, and that the new Ordnance Survey should be made on a scale to correspond with that in general use on the Continent of Europe.

I consider the scale bearing a definite numerical proportion to the linear measurement of the ground to be mapped, decidedly the best; and I cannot see any practical difficulty or inconvenience likely to arise from the adoption of a decimal scale.

No. 27.

MR. DAVID STEVENSON, CIVIL ENGINEER.

(See No. 11, at page 234.)

No. 28.

MR. F. W. SIMMS, late CONSULTING ENGINEER to the Government of India.

22, Keppel Street, Russell Square, January 25, 1854.

In reply to your communication dated the 16th instant, requesting my opinion upon the scale most suitable for the Ordnance Survey, I would state:—

1. That it would be very desirable to adopt a scale “bearing a definite proportion to the linear measurement of the ground,” provided the inconvenience arising therefrom would not be so great as to counterbalance its advantages; in such case the third scale named in your letter would answer very well, viz., $\frac{1}{2500}$ of natural size for rural districts, and $\frac{1}{500}$ for towns.

2. The inconveniences would arise from the scale being fractional, both as to the number of inches per mile, and all its usual subdivisions, as the number of chains, yards, and feet to the inch. This would be troublesome in practice so long as feet and inches are retained; the same objection would apply to any fractional scale whatever; and therefore, if it be finally resolved to adopt such a one, your third scale above-named had better be the one chosen.

3. However desirable in a scientific view the adoption of the scale in question may be, I think it would not be generally acceptable, particularly to practical men, for the reasons above stated, neither would any scale similarly involving fractions; I would therefore propose another, not subject to this objection, and which I consider would be sufficiently large for all practical purposes, namely, twenty inches to the mile for rural districts, which would be free from fractions in all the terms employed by engineers, architects, and surveyors, &c., thus:

20 inches to one mile.
= 4 chains to one inch.
= 88 yards to ditto.
= 264 feet to ditto.
= 0·25 of an inch to one chain.
= $\frac{1}{3168}$ of natural size.

No. 29.

MR. NATHANIEL BEARDMORE, LAND SURVEYOR, &c.

30, Great George Street, Westminster,
January 25, 1854.

In reply to your favour of the 16th instant, I should most decidedly advise that the scales to be adopted should bear a definite numerical proportion to the linear measurement of the ground to be mapped.

I think that the principle of the proposed scale cannot be productive of the slightest practical inconvenience; and the first step in the direction for the

adaptation of a uniform decimal system of measurement would outweigh the prejudice at first created by a novelty.

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of the Decimal
Scales.

The system of making plans and sections a decimal proportion of the full size is, when the metrical system is adopted, of infinite advantage in the abridgement of labour and appliances in the details of office work.

I believe that if the *Metrical* system were at once made compulsory by Act of Parliament, it could be adopted simultaneously in every office in the British empire without the slightest inconvenience, and with an after advantage that can hardly be estimated.

No. 30.

MESSRS. J. P. STURGE AND SONS, LAND AGENTS AND SURVEYORS.

(See No. 26, at p. 259.)

No. 31.

MR. JAMES JERWOOD, BARRISTER-AT-LAW.

9, Dix's Field, Exeter, January 25, 1854.

I beg to acknowledge the receipt of your letter of the 16th instant, requesting me to state which of three specified scales I would recommend to be adopted in the construction of the Ordnance maps.

Either of the three scales (using the numbers given in the third) would, as it appears to me, be sufficiently large for the accurate delineation of the details required for practical purposes. The difference between any two of them is small, and the third is just a mean between the first and second, at first sight therefore it seems difficult to prefer one to the others. But whilst the third scale, supposing the given numbers to be adopted, would equally suffice for the required purposes, it would in addition possess the peculiar advantage pointed out by the Statistical Society, namely, that of assimilating all the calculations to a simple decimal system; this consideration, in my opinion, turns the balance decidedly in its favour.

It is, I think, highly probable that, at no distant period, the decimal system of money, weights, and measures will be adopted in this country. Very likely, on the introduction of that system, some of the linear measures now in use will be modified or set aside. But it is the strong opinion of a great number of practical men, which may be seen in the Report of the Commissioners for Determining Standard Weights and Measures, that we must retain the mile, the acre, and the chain, and that the modifying or putting out of use either of these would unsettle a great number of documents with respect to land, and occasion so much confusion in the whole affairs of the kingdom, which the advantages accruing from the change would neither compensate nor justify; the reasons alleged in support of this opinion are no doubt entitled to careful consideration. I think they are almost irrefragable.

However desirable, and generally useful it undoubtedly will be, to adopt comprehensive scales of measurement for the national survey, and for general purposes, still we shall be obliged to retain some parts of the ancient system for daily use. Dr. Kelly in his "Cambist" tells us that even France, in everyday matters, has found the retention of some of the old modes indispensably necessary.

The fractions $\frac{1}{2560}$ and $\frac{1}{5120}$ result from the hypothesis that the mile will be adopted as the unit of linear measure. Whether a better one can be determined or not, forms no part of the present inquiry; and leaving that question out of consideration, I would recommend that scales bearing a definite proportion to the actual linear measurement on the ground be adopted; such scales would be applicable to any linear units, and independent of any particular ones. I take it for granted that the Government have determined to adopt scales not less than those named in the new circular.

I am unable to perceive that the adoption of the scales which I recommend would occasion any inconvenience. I have taken the opinion of surveyors of

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great experience, and they have assured me that a general map, constructed on such scale, would produce no practical inconvenience whatever.

In my last report, under the impression that the national map should be made to afford to the public as much useful information as possible, and that it was the duty of every one who had anything to do with the subject to assist in accomplishing that object, I suggested some points having that end in view; I, however, omitted to name one topic, which I now wish to mention, namely, the sea-shore land. This description of land, which is comprised between the high and low-water marks on the coasts round the kingdom, and on the navigable rivers, has been estimated to amount to upwards of 700,000 acres. The soil of this land, *primâ facie*, belongs to the Crown, though portions of it, no doubt, have been granted off to the owners of adjacent lands.

The value of this kind of land may, to some extent, be estimated from the legal proceedings which have taken place, and are still pending, between the Crown and the Corporation of London, the Birkenhead Harbour, &c. &c. But its importance, in a national point of view, will be much enhanced, should it be deemed expedient to put our coasts in a more efficient state of defence, in accordance with the advice of high authority. The Ordnance maps would appear to be very proper documents for precisely exhibiting the sea-shore land. I would, therefore, suggest that it be accurately set out on them; and that the parts which can be proved to have been duly granted off be distinguished from the remainder belonging to the Crown. I consider the subject to be of great interest, both to the Crown and to the public, and therefore trust to be excused for this digression in calling attention to it.

No. 32.

THE PRINCIPAL OF GLASGOW COLLEGE.

The College, Glasgow, January 25, 1854.

In compliance with the request of the Lords Commissioners of Her Majesty's Treasury, conveyed in your communication of the 16th current, I beg leave to say that I should, on the whole, prefer the scales for the intended Ordnance maps suggested in the proposal No. 3, viz.:

"Scales bearing a definite numerical proportion to the linear measure of the ground to be mapped:" it being understood that they were to be accompanied by correct tables for converting those scales into the recognised measures of Great Britain.

I have, &c.
(Signed) D. MACFARLAN.

No. 33.

THE DEPUTY CLERK REGISTRAR.

Her Majesty's General Register House,
January 25, 1854.

With reference to your Circular of the 16th instant, requesting me to inform the Lord Commissioners of the Treasury which of the three scales therein mentioned I would recommend for the map to be constructed from the Ordnance Survey, I beg to state that I am disposed to recommend the adoption of the third.

I think the scale sufficiently large for all objects for which surveys and plans are usually made, and I believe that the general adoption of such a scale, or a proportion of it in the construction of maps, would ultimately be productive of great convenience.

I have, &c.
(Signed) W. P. DUNDAS.

No. 34.

MR. JOHN HAWKSHAW, CIVIL ENGINEER.

33, Great George Street, Westminster,
January 26, 1854.Replies in favour
of the Decimal
Scales.

In reply to your communication of the 16th instant, on the subject of the scales for the Ordnance Survey, I beg to state that, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made, then I should recommend scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped. In my opinion, the adoption of decimal scales would be productive of no practical inconvenience worth naming.

Perhaps I may be permitted to observe that $\frac{1}{500}$ or 10 feet $6\frac{2}{3}$ inches, or thereabouts, for towns, is I think larger than necessary. Plans made to that scale will be very large and unwieldy; and, so far as my experience goes, upon a scale of about five feet to the mile, everything important to be shown in town surveys can be distinctly delineated.

No. 35.

MESSRS FOX, HENDERSON, AND CO., CIVIL ENGINEERS.

8, New Street, Spring Gardens,
January 26, 1854.

We have the honour to acknowledge the receipt of the circular letter addressed to us, under date 16th instant, on the subject of the Ordnance Survey, in which you request us to state, for the information of the Lords Commissioners of Her Majesty's Treasury, which of certain scales referred to we would recommend, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made.

And in reply we beg to state that we would recommend scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped, *i.e.* the scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns; the adoption of which in our opinion would not be productive of any practical inconvenience.

No. 36.

UNIVERSITY OF ST. ANDREW'S.

St. Andrew's, January 25, 1854.

Having, at a recent meeting of the members of the Senate of this University, brought your letter of the 16th instant under their notice, I am authorised to state that they beg to recommend the adoption of the third, in the list of scales, and that they do not think any practical inconvenience will arise from its decimal character.

I have, &c.
(Signed) WILLIAM BROWN, Rector.

No. 37.

MR. J. HUGHES, CIVIL ENGINEER.

34, Great George Street, Westminster,
January 25, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th instant, requesting me to inform the Lords Commissioners of Her Majesty's Treasury, which of the three sets of scales, therein described, I would recommend for adoption in the public maps to be prepared from the Ordnance Survey, supposing it to be determined that the scale shall be sufficiently large to compre-

Replies in favour
of the Decimal
Scales.

hend all the objects for which surveys and plans are usually made; and in answer I have the honour to state that I consider the scales of $\frac{1}{2500}$ for rural districts, and of $\frac{1}{500}$ for towns, as by far the most eligible for adoption, of those three proportions between the scale of the map or plan, and the actual measurement of the ground.

I beg leave also to add, that I cannot conceive any practical inconvenience to be produced by the adoption of these decimal scales, but, on the contrary, that I feel warranted by some experience in the use of Continental maps and plans for engineering purposes, in expressing my belief that such scales would be found to offer many advantages.

No. 38.

MR. CHARLES BAILEY, LAND AGENT, &C.

Nynehead, near Wellington, Somerset,
January 27, 1854.

Although I am of opinion that all the scales mentioned in your letter of the 16th instant are unnecessarily large for all the objects for which surveys and plans are usually made, yet as it seems one of the three therein set forth will be adopted, I think the third the preferable; and I am of opinion that the adoption of the decimal scales would be productive of practical convenience.

No. 39.

CITY SURVEYOR OF NORWICH.

Surveyor's Office, 24, Castle Meadow,
January 27, 1854.

I have to acknowledge the receipt of yours of the 16th instant, containing questions from the Lords Commissioners of Her Majesty's Treasury in reference to proposed scales for surveys and plans, and beg to inform you that, in answer to the first question, I consider the third series of scales proposed, to be the best; and in answer to the second question, that the usual measurement for plans now used, viz., scales of chains and links, being a decimal system, the adoption of any other decimal system of scales can be productive of no practical inconvenience.

I have, &c.
(Signed) E. E. BENEST.

No. 40.

MR. WILLIAM FAIRBAIRN, CIVIL ENGINEER,

(See No. 15 at page 235.)

No. 41.

THE REGISTRAR GENERAL.

General Register Office, Somerset House,
January 28, 1854.

In reply to your letter of the 16th inst., I will thank you to state to the Lords Commissioners of Her Majesty's Treasury, that I agree with the Statistical Society of London and the Statistical Conference at Brussels in thinking that those scales are preferable for the Ordnance Survey which bear a definite proportion to the linear measurement of the ground, more especially as those scales would be found to bear adaptation to the units of measure now in use, and to any other units which the introduction or further development of the decimal system may hereafter suggest.

I have, &c.
(Signed) GEORGE GRAHAM.

No. 42.

SIR HENRY DE LA BECHE, C.B., F.R.S.

(See No. 17 at page 236.)

Replies in favour
of the Decimal
Scales.

No. 43.

MR. J. MAC GREGOR, M.P.

South Eastern Railway, London Terminus,
January 31, 1854.

I have the honour to acknowledge the receipt of your circular letter of the 16th instant, on the subject of the Ordnance Survey.

I think the proportionate scale set forth in No. 3, would be most convenient.

In scaling a plan it would require only to multiply by 2500 or by 500, as the case might be.

I do not see any practical inconvenience that could result therefrom, the constant multipliers would always be readily remembered.

No. 44.

MR. STEPHEN EDDY, LAND AGENT, &C.

Grassington, Gargrave, Leeds,
January 31, 1854.

In accordance with the request contained in your favour of the 16th, I beg to say, I would most strongly recommend the adoption of the scales recommended by the Statistical Society of London, and the Conference of Brussels.

I have often seen the decimal scales in use on the Continent, and consider them preferable to those in general use in this country.

The first introduction of the decimal scales would perhaps occasion a little inconvenience to those unaccustomed to them, but I think they would soon meet with the approval of all practical men.

No. 45.

MR. GEORGE P. BIDDER, CIVIL ENGINEER.

(See No. 35 at page 263.)

No. 46.

MR. HENRY M^CLAUHLAN.

London, January 31, 18

Having already given an answer to the two first questions I have herein the honour to receive, in my reply dated September 5, 1853, to a former letter, I have only now to state, regarding the third question, that I cannot see any practical inconvenience likely to arise from adopting the scales therein mentioned, namely, 2 feet $1\frac{1}{3}$ inches to the mile for rural districts, and 10 feet $6\frac{2}{3}$ inches to the mile for towns; particularly when I learn that these fractions of the actual surface are those "in general use on the continent of Europe."

No. 47.

MESSRS. PRATT AND SON, LAND SURVEYORS, &C.

Queen Street, Norwich, February 1, 1854.

We beg to acknowledge the receipt of your letter of the 16th ult., relative to the Ordnance Survey, and asking our opinion as to what scale we would recommend for surveys and plans.

Replies in favour
of the Decimal
Scales.

We are of opinion that a scale bearing a definite numerical proportion to the linear measurement of the ground mapped is the most simple and suitable for general use, and we think the proportions named in your circular, that is, $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns, are well adapted for practical purposes; the adoption of which would be productive of no inconvenience after the issue of scales graduated to those proportions had obtained a general circulation.

No. 48.

REV. RICHARD SHEEPHANKS.

Athenæum, February 1, 1854.

In reply to your circular of the 16th January, I wish to say that I give a decided preference to the third scale over the other two, and that I prefer the first scale to the second. All are pretty much on a par as to accuracy, and I should expect, from the superior method and skill of the Ordnance Surveyors, that the results will be far more exact and trustworthy than any partial survey has been or is likely to be.

I prefer the third scale, because it connects in the simplest and most direct manner the relation between the thing itself and its representation. Any measure on the map with any scale, will give the measure on the land on the same scale by a very easy multiplication, and *vice versa*. It is an advantage, too, that this scale is in general use on the Continent, and that it is free from any national peculiarity.

One presumed advantage in the first and second scales, seems to me rather the contrary. In a survey by triangulation, if proper checks be used, no sensible error can arise, except in the sub-measurement and in plotting from the field-books. I understand that the principal points will be settled by triangulation, and that the stations will be, as far as practicable, preserved. The accuracy of the plotting will depend very much on the accuracy of the plotting scales, and it is very necessary to look sharply to this point. If these depend on *inches*, there will be a temptation to use *existing* scales, and generally speaking these are of a very second-rate kind. If new and special scales be introduced for the Ordnance Map, I am pretty sure that the slight extra expense will be repaid a hundredfold in the finish of the work.

I should object to any proportion being adopted which recognised as fundamental such a measure as the land-chain of 22 yards. The acre is too firmly rooted to be meddled with; and therefore, in practical surveys, there is a practical utility in using a measure which has a decimal relation to the acre. But I see no such advantage in a great and general survey. The maps for the tithe commutation must be far too inaccurate (except in acreage) to be used in the new map, for it is only by triangulation that even moderately distant points can be properly referred to each other.

I cannot see any practical inconvenience from the adoption of the first or third scale, except that in both cases fresh plotting scales may be required. I presume that all areas will be stated in acres and decimals of an acre, and all lengths in yards and decimals of a yard, or in feet and decimals of a foot. The mixture of denominations must be a very fertile source of error to ordinary persons.

No. 49.

MR. JOHN M^cMILLAN, LAND AGENT, &c.

Newtonstewart, February 2, 1854.

In answer to your letter of the 16th ult., I beg to state that I consider any one of the three scales therein mentioned, would be amply sufficient to comprehend all the objects for which surveys and plans of rural districts are usually required; and that I see no practical objection to the adoption of the decimal scales. The scale No. 2 would perhaps be found most convenient in taking measurements from the map. As to the suitable scale for town districts, I do not feel competent to offer an opinion.

No. 50.

MR. WILLIAM RANGER, CIVIL ENGINEER.

London, 2 a, Pall Mall, February 3, 1854.

In reply to your letter of the 16th January, requesting me to state what scales are, in my judgment, the best to be adopted in future by the Ordnance for their surveys of both town and rural districts, (assuming that those, in favour of which I expressed my opinion, in a letter to you of the 16th of September last, are not considered large enough to meet all the requirements of the case,) I have the honour to lay before you the following statement.

A scale of three chains to the inch, or $26\frac{2}{3}$ inches to the mile, has this advantage over one of 24 inches to the mile, that the former is more in use than the latter, and is therefore more generally known throughout the kingdom. This and the scale of four chains to the inch were those to which the first-class tithe maps were plotted.

The proposed scale of $\frac{1}{2500}$ being equal to $25\frac{1}{2}$ inches to the mile, is a mean between the two already mentioned.

I highly approve of the proposed adoption of this scale, both for its uniformity, and also because its introduction will probably lead to a general system of decimal notation.

I do not consider that the change would cause any practical inconvenience to the Ordnance, though some time would necessarily elapse before it could be generally known or recognized by private surveyors.

With regard to the comparative advantages of the two scales proposed for town districts, viz.: 10 feet to the mile, or $\frac{1}{500}$, I regard the difference between them so slight, as not to be, practically, perceptible. Should however a decimal scale be adopted for rural districts, it would be preferable to carry out the same system for towns also.

No. 51.

MR. JOSEPH GIBBS, CIVIL ENGINEER.

Abingdon Street, Westminster,

February 2, 1854.

In reply to the communication you have done me the honour to make requesting my opinion in the change in the scales of measurement proposed to be made in future as respects the Ordnance Survey:

It appears to me that the several scales numbered, viz., one, two, and three in your letter, are, although not too large for the operation of the surveyor, yet are extremely inconvenient for all practical purposes of mapping, my views of the question being, that although a map could ultimately be obtained on these large scales, yet, from the immense size and inapplicability to practical purposes, the original would merely become a national archive, and in a great measure inaccessible to the public, besides the time of its completion would be so remote that its value would only be realized by a future generation.

What I beg to draw your Lordships' attention to is, the necessity of adopting such a scale for a map as shall render it of general utility, and if plotted to a dimension so far reduced, that it may be engraved in a short time, in which case some portion of the present generation may see its completion, and be benefited by its existence. I am justified in this remark by a reference to the Ordnance Survey of London, which, from its great size, has never yet been completed, except so far as to present a skeleton plan of roads, the very sewers and water courses being left out, although these were the leading objects of the plan; on the contrary, the town of Oxford, because they adopted a smaller scale, possess a well-arranged, cheap, and useful plan, available for all practical purposes, and the same may be said of several other towns and parishes.

Having made these remarks in reference to all the scales referred to in your letter, I beg to state that if it is your Lordships' decision to adopt one of those enumerated, I strongly urge on your Lordships' attention the necessity of adopting the third proposition, because the scales referred to admit of a decimal arrangement.

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Having stated so much in objection to the several scales proposed, it is right to suggest for your Lordships consideration the system of measurement I think preferable, and the dimensions I recommend, the adoption of which would be a progressive advance towards the decimal system of land measure, without, however, making either an inconvenient or too sudden alteration in the measure in use.

	Inches.
The maps of towns to be plotted to one Measure to the mile, or - - -	- 36·00
The maps of rural districts to be plotted to four tenths of a Measure to one mile, or - -	- 14·40
The engraved maps to be laid down to two tenths of a Measure to one mile, or - - -	- 7·20

This last scale would be a little longer than the Ordnance Survey of Ireland and the New Survey of the North of England, viz., six inches to one mile.

The standard Measure to be a legal yard, as settled by Act of Parliament.

The yard to be called a Standard Measure, and to be divided into ten parts, and each be called a Tenth.

The Tenth to be divided into ten parts, and to be called a Hundredth.

The Hundredth to be divided into ten parts, and to be called a Thousandth.

The measure of lengths would be as follows:—

	Inches.
One Measure equal to one yard, or - -	- 36·00
One Tenth equal to - - -	- 3·600
One Hundredth equal to - - -	- 0·360
One Thousandth equal to - - -	- 0·036
Feet.	
10 Measures to be one decimal pole, or -	- 30
100 square Measures, one acre, or -	- 900
1,000 longitudinal Measures, one mile, or -	- 3,000
100,000 square Measures to be a Square of land.	

It will be perceived that Saxon words to denote the divisions now introduced are extremely simple, and their names associated with short words of great familiarity. This system would, no doubt, be readily adapted hereafter to a general decimated measurement applicable to the business of ordinary manufactures and commercial transactions of the country.

No. 52.

MR. JONATHAN PIM.

Dublin, 1th of second month, 1854.

Absence from home during part of the time, and other circumstances, have prevented an immediate acknowledgment of the circular of the 16th January, requiring me to state which of the three scales therein set forth appeared to me most advisable for the Ordnance Survey.

Although I felt that my opinion on such a subject was of very small value, I gave immediate attention to its consideration, and having checked my own views by the opinions of others, I have now to state that the scale No. 3 appears to me the most desirable to be adopted.

Being a definite proportion of the actual surface, it speaks the same language to educated men of all nations, and is independent of any arbitrary standard of measurement. I think the practical inconvenience may be avoided by engraving a scale on each map, reducing it to the local standard.

No. 53.

THE CHANCELLOR OF THE DUCHY OF LANCASTER.

Duchy of Lancaster Office, February 10, 1854.

I beg to acknowledge the receipt of your letter of the 16th of January, in which you request me to inform you, in case of its being determined to adopt

for the Ordnance Survey a scale sufficiently large to comprehend all the objects for which surveys and plans are usually made, *which* of the following scales I should recommend, viz. :

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1st. A scale of 24 inches to the mile for rural, and of 10 feet to the mile for town districts.

2nd. A scale of three chains to the inch, or $26\frac{2}{3}$ inches to the mile for rural, and of 10 feet for town districts ; or

3rd. Scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped ; that is, the scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns, as recommended by the Statistical Society of London, and the Statistical Conference of Brussels.

The principal question for determination appears to be, whether it is desirable that the scale shall have reference to our existing measures, or whether it should bear a definite proportion in round numbers to the linear measurement of the ground.

One advantage attending a scale on the latter principle, is, that the simple announcement of the scale at once conveys to every mind a distinct conception of the proportion which the map bears to the ground which it represents, without requiring any arithmetical computation, or even any knowledge of our existing measures.

Another important recommendation of this principle is, that it is in conformity with the practice of the other nations of Europe, and that it will allow of our maps being constructed on the same scale as theirs.

The only disadvantage which occurs to me as attending the adoption of such a scale is, that an ordinary English rule measure will not, when applied to the map, serve the purpose of a scale, as it might do if the scale of the map had reference to feet and inches. This objection, however, does not appear to be very important ; more especially as a scale is ordinarily attached to every map, from which distances may be taken off by compasses, and as it would be practicable to sell with the map, at a very low price, a loose scale on pasteboard, wood, or other light material, which would answer every purpose.

For these reasons I am of opinion, that having regard to existing circumstances, it is desirable to adopt a scale bearing a definite proportion to the linear measurement of the ground.

It is necessary, however, in engaging in so important an undertaking, not merely to have regard to existing circumstances, but to provide as much as possible against future events, so far as they may affect the present decision. The Legislature has of late shown some disposition to adopt a decimal system of coinage, and one step has already been taken in that direction in the issue of a new coin. Should a decimal coinage hereafter be adopted, and be found to work advantageously, there is every reason to presume that a similar system would be applied to our weights and measures. In that event a scale which had reference to feet and inches would be deprived of the only advantage for the sake of which it had been selected ; so that, were we now to adopt such a scale, we might find in no great number of years, that our Ordnance maps were so constructed as to bear no convenient proportion, either to the ground itself, or to our authorised measures. On the other hand, a scale bearing a definite proportion to the measurement of the ground, would, in the event of the adoption of a decimal system of measures, acquire the additional advantage of bearing a definite proportion to those measures. Consequently the arguments in favour of this scale would be materially strengthened by the probability of any alteration in our present system of measures.

For these reasons I beg to recommend a scale of $\frac{1}{2500}$ for rural districts, and of $\frac{1}{500}$ for towns.

(Signed) EDWARD STRUTT.

No. 45.

MR. THOMAS PAGE, CIVIL ENGINEER.

Whitehall Yard, February, 1854.

I have the honour to acknowledge the receipt of your communication of the 16th ult., on the subject of the scales for the Ordnance Survey, and in

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reply thereto I beg leave to submit to you, for the consideration of the Lords Commissioners of Her Majesty's Treasury, the following observations.

As the scale applied for the measurement of any map or plan should exactly coincide with the scale used in constructing it, which scale should be formed on the paper at the commencement of the drawing, so that it may expand or contract with the drawing, it follows, that no detached scale, whether of wood, ivory, or paper, nominally the same as the original scale, can be of any service when applied to the measurement of plans, unless such detached scale should correspond exactly at the time of measurement with the scale on the drawing, and any conclusion deduced from such measurement would be erroneous.

In consequence of atmospheric and other influences causing differences in the expansion of paper at the time of drawing and printing a set of plans, it generally happens that the scales on the printed plans, although purporting to be the same scale, vary considerably in the total length; and as an example of this, I inclose for your notice copies of scales from Ordnance plans in my possession, showing a difference of $\frac{1}{70}$ between the extreme examples.

It would therefore follow, that there would be no advantage, but the contrary, in using integers of feet or inches as scales for the construction and measurement of plans; and to avoid the liability to error by the application of ordinary detached scales, it is desirable to introduce a scale which should bear a definite numerical proportion to the linear measurement of the ground to be mapped; and I am of opinion that the adoption of these decimal scales would not be productive of any practical inconvenience.

It appears to me, however, that $\frac{1}{500}$ of the linear measurement is a larger scale than would be required for town surveys, except in particular cases, and that $\frac{1}{1000}$ would be amply sufficient for towns in general; but that in all cases as many figured dimensions should be given on the engraving as would not confuse it; and this observation would apply to the important dimensions of the plans of rural districts.

It may also be deserving of consideration whether an intermediate scale should not be used for the suburban districts where buildings are likely to increase.

To avoid the differences in the scales of the engraved plans, the plates should be engraved at the same temperature; the paper for the drawings and engraving should be of the same kind, excellent and uniform in quality; the atmosphere of the place in which the paper is kept, and the drawing and printing performed, should be in a uniform condition as to its temperature and hygrometrical state, and with these precautions a closer approximation to truth would be attained.

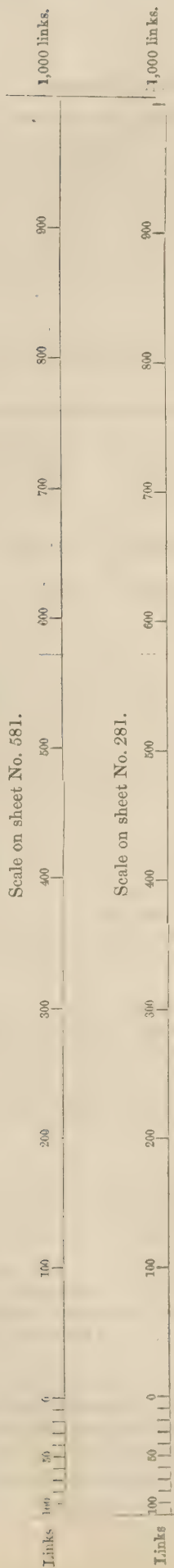
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DIAGRAM OF SCALES.

ORDNANCE MAP OF LONDON.

Scale 5 feet = 1 Mile.

Scale on sheet No. 581.

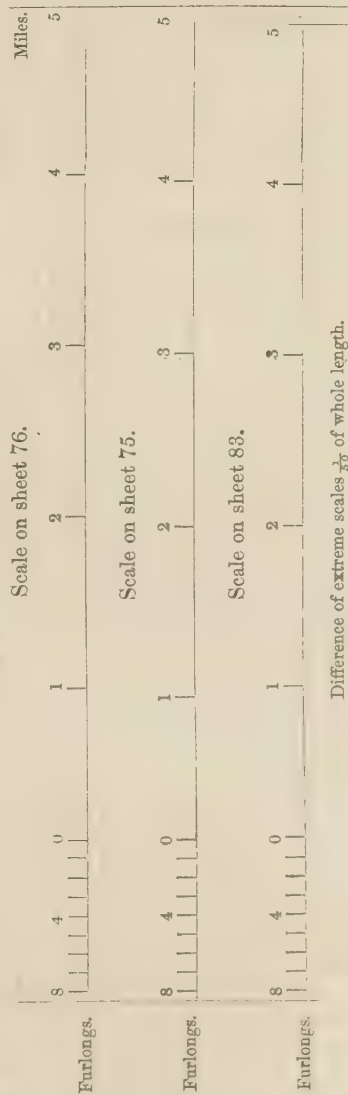


Scale on sheet No. 281.

Difference of scales $\frac{1}{8}$ of whole length.

ORDNANCE MAP OF ENGLAND.

Scale 1 inch = 1 Mile.



Difference of extreme scales $\frac{1}{30}$ of whole length.

MR. JOSIAH PARKES, CIVIL ENGINEER.

11, Great College Street, Westminster,
February 14, 1854.

In answering the letter you have addressed to me, by command of the Lords Commissioners of Her Majesty's Treasury, on the subject of the Ordnance Survey, requesting me to inform their Lordships which of the three therein-stated scales I would recommend, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made, I will confine my reply, as nearly as I can, to the matters submitted to me for consideration.

As regards rural districts, the three scales to which my attention is directed, are the following, and in the annexed table I have exhibited their more important relations under several different aspects.

Number of the Scale.	Inches to One Mile.	Chains of 22 Yards each to One Inch.	Ratio of Linear Dimension on the Map to the actual Linear distance.	The same Ratio in Decimals.	Square Inches on the Map representing a Square Mile.	Number of Acres in a Square Mile of Ground.
1st.	26·66666	3·	$\frac{1}{2376}$	·000420875	711·11111	640·
2nd.	24·	3·33333	$\frac{1}{2640}$	·000378787	576·	640·
3rd.	25·3440	3·15656	$\frac{1}{2500}$	·0004	642·3183360	640·

Each of the three scales will be sufficiently large, not only for delineating on the map, with clearness, all those objects which are usually comprehended in the best estate surveys of rural districts, but also for inserting in the map precise particular local information on the various topics, respecting which it concerns proprietors and the State to possess accurate knowledge; such knowledge as tends to prevent inconsiderate and unproductive outlay of capital, and to promote the progress of profitable expenditure and permanent improvement. Maps and surveys made by public authority, and with scrupulous accuracy, according to either of the three scales in question, will be subservient to those various public purposes of paramount national importance which are adverted to in the well-known letter of the late Lord Langdale. Of the three scales, I decidedly prefer the third, recommended by the Statistical Society of London and by the Statistical Conference at Brussels; and I do so for the following reasons:—

First, This scale bespeaks favourable consideration, as being nearly a mean between the other two scales with which it is required to be compared.

Secondly, the numerical ratio of 4 to 10,000, which would be the ratio of linear dimension on the map to the actual linear distance thereby represented, is a ratio of far greater simplicity, and better suited to numerical computation, than are the ratios corresponding to the other two scales, respectively. In proof of which, I refer to the preceding table.

Thirdly, because this ratio is, necessarily, independent and irrespective of the actual land-measures which now are, or hereafter may be, in customary or authorized use, in this or in any other country; since, expressing as this ratio does merely what fraction the sign or representation of linear distance is of the distance intended to be represented, it is not liable to fluctuate with time or place; and ought therefore to be stamped with the character of permanence and ubiquity. The ratio should be that which, on careful consideration, shall appear best suited for the purposes of a survey, to all civilized countries in all times.

Fourthly, because in adopting ourselves the scale which has been adopted by Continental Governments as the scale for their respective cadastres, we call them in, as it were, in the character of impartial judges, divested of our local prejudices, to assist us in our deliberations on the question of what is the best scale for a cadastre; and in deciding this question we avail ourselves of their experience.

Lastly, I beg to point out a curious result, which tells in favour of the third scale. Since a square mile of ground contains 640 acres, and a square mile as delineated on the map, provided the ground be level, would contain 642·318336 square inches; consequently every square inch on the map would represent very nearly, though not exactly, an acre of ground: that is to say x square inches on the map would represent $[1\text{---}0036098] x$, or $\cdot9963907 \times x$ acres of ground; and conversely x acres of ground would be represented by $1\cdot0036224 \times x$ square inches on the map. This relation would give facility to the computation of areas by means of the map, if the third of the three scales were adopted.

In answer to the question, whether, in my opinion the adoption of the scale of 4 parts to 10,000 would, for rural districts, be productive of any practical inconvenience; I beg to state, as a practical man, that it would not. The parties who are professionally engaged in land-operations, have almost universally of their own accord, for the saving of their own time and for their own convenience, adopted, both for measuring and computing, a linear and a square unit, and the decimal divisions of these respective units. The linear unit is the chain, 22 yards long, which they divide into 100 links; and their square unit, the parts of which they express decimally, is the square of the linear chain. The results of their measurements and computations, obtained in terms of the square unit and its decimal parts, they translate in most cases, for the use of their employers, into the ordinary language of acres, roods, and perches. Such parties are used, therefore, to decimal computation, and it would be consulting their convenience and habits to adopt the third scale.

On the question, what is the proper scale for towns and their suburbs, my experience of works in towns is not sufficient to enable me to pronounce an opinion entitled to much weight; but it is obvious that the question in this case is, what multiple of the scale adopted for rural districts shall be the scale for towns.

Assuming that, for rural districts, the first or second scales were preferred to the third scale; and that the quintuple of the scale so preferred were deemed the most suitable for some particular town, then it would follow that in case, not the first or second, but the third scale, were the adopted scale for rural districts, its quintuple, or $\frac{1}{5\cdot0}$, would be the fit scale for that same town. It is not, therefore, necessary for me to enter further upon this branch of inquiry.

Lest the opinion I have expressed in favour of the third scale should be misunderstood, I beg permission to add, that the recommendations I make of the country engaging in so vast and costly an undertaking, are grounded on the following assumptions:—

First, That the requisite steps will be taken to secure the results from being lost or destroyed, and to hand these results down to future generations, by engraving them on the same scale as that of the survey itself; and so multiplying copies of the original.

Secondly, That the requisite steps will also be taken to ensure accuracy in the copies, and to give the copies authority as public documents; and these ends can only be attained by engraving the maps on the scale of the original.

Thirdly, That such engraved copies shall be sold to the public, on application, at a very moderate cost. In this way the country will receive, as it is entitled to do, a return for the original cost.

I trust also that the completion of the Ordnance map on the scale of one inch to the mile may not be interfered with by this greater undertaking.

No. 56.

VISCOUNT EBRINGTON.

Grosvenor Square, February 13, 1854.

Notwithstanding the trouble and expense already incurred, both by the Ordnance, and (in consequence of the slowness and costliness of Ordnance work) by private engineers and surveyors for the Local Boards of Health and the Commissioners of Sewers, in the preparation of maps and of plans of towns, I am decidedly of opinion that the scales recommended by the Statistical Society of London and the Statistical Conference at Brussels should be adopted for the Ordnance Survey. The difference in size between these and the English

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scales mentioned in your letter, is quite immaterial, and I cannot imagine that any inconvenience of any moment could arise from an adoption of them: certainly none in my opinion at all sufficient to outweigh the obvious advantage of thus assimilating the scales of our surveys to those in general use on the continent of Europe.

It seems most desirable that in surveys, as in other matters, a uniform standard should be adopted by all civilized nations, wherever the inconvenience of its adoption would not too seriously preponderate.

No. 57.

MR. THOMAS THURSTON, LAND SURVEYOR.

Ashford, February 25, 1854.

I have refrained from replying to the communication as to the scale of the Ordnance Maps, till I could give it mature consideration.

I am of opinion that a scale which bears a decimal proportion (easily calculated) to the longitudinal surface of the ground is that which is most desirable to adopt.

I recommend this on the supposition that sooner or later the decimal system will pervade all our commercial calculations, and a long-continued wish to see this introduced makes me beg the favour of a few remarks on this subject.

Supposing that a wish will soon arise to introduce a decimal system into the longitudinal measures of the kingdom, I have long contemplated what should be the unit of the integral number, and of what known measure it should be a multiple or a part. I feel strongly the conviction that the measure known as "Gunter's Chain" of 22 yards should be the recognized parent of every number, being of 100 links; and I am inclined to think the link should be the first place of decimals. The question would then arise as to the most convenient substitute for the yard in counter work: I should say one of five links, which will be as near as possible to the French metre, being 39.6 inches. This similarity would greatly facilitate commercial transactions between the countries. The tenth of a link would be a convenient substitute for the inch, and these measures would easily square into the present square measure as recognised in the statute acre.

I foresee many difficulties in the introduction of any measure which shall supersede the yard and inch; but if a decimal system be adopted, the introduction of either of these would involve the same difficulty in the square measure of the country, and as one of the two must be lost, the transition would be almost as difficult, and fewer old landmarks remain.

Should the introduction of any decimal system be considered too Utopian for practice, I would abandon the request of the Statistical Society, as it would have little to recommend it; and then a question arises whether the simplicity of the first scale is more advantageous than the adoption of the scale of three chains, now in general use among surveyors and engineers.

Few but scientific men will ever examine the minutiae of the scale, and they may be divided in the way they read it. Surveyors would prefer their known scales of 3 chains, $2\frac{1}{2}$ or 4 to the inch. Architects and their disciples prefer the inch and its quarters and eighths. Now these two views might have been combined by a lesser scale of 4 chains to an inch or 20 inches to the mile, and 1 chain to the inch, or 80 inches to the mile for town districts.

Not being acquainted with the views of the Board, I am unable to judge why such large scales are selected, while I think that of 4 chains, when done with accuracy, will convey every desirable particular to paper. Having seen a little of the Ordnance work, I must feel that the great accuracy of that department originates in its large triangulation, and descends wherever instrumentation is adopted; that the great accuracy of its indoor department will hardly be equalled in the minutiae of the outdoor surveyors; and that therefore a 4-chain engraving will be sufficiently distinct to convey every general feature to paper.

Entertaining this view most decidedly, I should not act properly in withholding it, though I feel it will have no individual weight; but how it would simplify the comparison in the scale!

In conclusion, looking to an ultimate decimal system of measurement, I would recommend pursuing the system in so national a work by the Statistical Society's scale. Replies in favour
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Scales.

But abandoning the decimal system, I recommend the first scale.

As to the practical inconvenience of the decimal scale, few practical men would have a scale by them to apply to the maps, whereas in the other scales it would more frequently happen, and in the 4-chain scale the foot-rule would always be applicable.

No. 58.

MR. JAMES M. RENDEL, CIVIL ENGINEER.

8, Great George Street, Westminster,

February 20, 1854.

I have the honour to acknowledge your letter of the 16th ult. asking, on behalf of the Lords Commissioners of Her Majesty's Treasury, which of the three undermentioned systems of scales I would recommend for the Ordnance Surveys.

		For Rural Districts.	For Town Districts.
First	- -	24 inches to a Mile	10 feet to a Mile.
Second	- -	3 chains to an inch -	Ditto.
Third	- -	$\frac{1}{2500}$	$\frac{1}{500}$

I may remark, that as in each of the three systems, the size of the map bears nearly the same proportion to that of the original, the question is reduced really to one of nomenclature; and in this respect I give a decided preference to the *third*.

My principal reason for so doing is, that such a system is the simplest and most natural method of reduction, being altogether independent of arbitrary units of measurement, a point of some importance looking to the rapid progress which is now making towards the introduction of the decimal system of currency in this country, which will, it cannot be doubted, be ultimately extended to weights and measures.

It is quite possible that the introduction of such scales may cause at first a slight inconvenience to, and consequently meet with opposition from, some of those who have not been accustomed to them; but I am confidently of opinion that both the inconvenience and opposition would be only temporary, and would be scarce worth of mention in comparison with the advantages gained.

No. 59.

MR. W. C. MYLNE, F.R.S., CIVIL ENGINEER.

New River Head, February 22, 1854.

In reply to yours of the 16th of January last, I beg to say, for the information of the Lords Commissioners of Her Majesty's Treasury, that there can be no objection to the adoption of the smaller scales mentioned in the first and second questions; but any plan to the scale of ten feet to the mile must be, from its size, most inconvenient, and in all my communication with practical men I have invariably heard the same opinion expressed. Even for the deposit of plans at five feet to the mile, rooms have to be purposely erected, so that the public may inspect such plans of works as may be under construction, should they at any future time be so disposed. As regards the third—the numerical proportion to the linear measurement, such I conceive would be desirable.

FINANCE COMMITTEE, COUNTY OF INVERNESS.

Beaufort Castle, February 22, 1854.

In reply to your letter of the 16th January on the subject of the Ordnance Survey, I beg to enclose an extract of the minutes of a meeting held yesterday at Inverness with reference to that subject.

(Signed) LOVAT.

EXTRACT from the Minutes of a Meeting of the Finance Committee of the County of Inverness, held at Inverness on the Twenty-first day of February, eighteen hundred and fifty-four years.

The Right Honourable Lord Lovat, Lord Lieutenant of the County,
in the chair.

There was read to the meeting a communication from the Treasury on the subject of the Ordnance Survey; and the meeting, at the suggestion of the chairman, recommended the adoption of the scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped, that is, the scale of $\frac{1}{2500}$ for rural districts and $\frac{1}{5000}$ for towns.

The Committee is not aware that the decimal scales would be productive of any practical inconvenience.

No. 61.

LIEUTENANT COLONEL LARCOM, R.E.

Dublin, February 23, 1853.

I have the honour to transmit herewith replies to the queries addressed to me, on the large scales proposed for the Ordnance Survey, by your letter of the 16th ultimo.

I. 24 inches to one mile.

II. $26\frac{2}{3}$ inches to one mile, or three chains to one inch.

III. Scales bearing a definite numerical proportion to the linear measurement of the ground.

I. The first has the advantage of agreeing with the Ordnance scales, being a multiple of them, and itself indeed occasionally used; which, as the whole of Ireland, and parts both of England and Scotland are surveyed, engraved, and published on those scales, is greatly in its favour; and the more so, if, as I cannot but think will be the case, a map on some such scale as six inches will still be found necessary; because in that event, the six inch surveys already made will be available—will merely have to be continued.

II. The second has also advantages. As the scale enlarges, its expression in miles becomes inconvenient. A smaller measure, like the chain, is more natural; and if the field were open, and everything were beginning anew, and if it related only to detached plans, I should see much to approve in this scale. But I should not think its divisions so convenient for general maps on smaller scales, and they ought to be multiples of each other. On the whole, between these two, I prefer the 24 inch.

III. I see no objection to this scale equivalent to the advantages ultimately to be expected from its adoption, as facilitating the introduction of decimal measures. It may not be generally understood at first. New instruments with proper divisions must at some expense be provided, and the draftsmen trained to use them. It will not be a multiple of the existing maps, nor of our feet or inches, and we cannot therefore take distances from the maps by those measures. But scales of miles, &c. can be constructed on the maps themselves to measure by, and the instrument makers will soon supply the public with new scales abundantly. Double scales, or equivalent scales, can be made for comparison with existing maps; and though they differ from our present maps, they will agree with those on the Continent, and with decimal measures in future, so that if not adopted now, when the opportunity offers, it will be matter of regret hereafter. On the whole it is a step in advance, and I think may be safely taken.

No. 62.

MR. WILLIAM FOSBROOKE, LAND SURVEYOR, &c.

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Hereford, February 24, 1854

In reply to the circular letter of the Lords Commissioners of Her Majesty's Treasury of the 16th ult., I beg to state that I am of opinion that the scale mentioned thirdly in that circular would be the best for a general survey; and I do not foresee any inconvenience that can arise if a general survey is carried out, notwithstanding it is different to any scale hitherto used in this country.

I made a very considerable number of surveys and first-class maps under the Tithe Commutation Act, all upon a scale of three chains to the inch, and as the above scale is nearly as large, I think it preferable.

No. 63.

MR. CHARLES HUMBERT, LAND AGENT AND SURVEYOR.

Watford, February 24, 1854.

I am satisfied that for the public at large, and particularly for land surveyors and engineers, a scale bearing a definite numerical proportion to the linear measurement of the ground to be mapped would be, when once they became familiarised with it, (and there would be no practical inconvenience in the change), far more convenient than the scales now in general use; and as I hope to see it adopted for the new Ordnance Survey, I fear that many land surveyors to whom you have referred this question may have inconsiderately reported in favour of the scale of three chains to the inch, as being that which is universally admitted to be the most efficient for rural surveys, without having observed how closely that named by you of $\frac{1}{2500}$ approximates to the three chain scale.

I think that scales smaller than $\frac{1}{2500}$ for rural districts, and $\frac{1}{5000}$ for towns should not be adopted, as I am sure, that on smaller, could not be shown all the detail that is required to render the survey permanently and extensively useful to practical men, and to land proprietors; nor on anything less would it be possible to record the alterations that are constantly taking place on the surface of the country.

No. 64.

HON. CHARLES GORE, COMMISSIONER OF WOODS, &c.

Office of Woods, &c., February 24, 1854.

In Sir C. E. Trevelyan's letter of the 16th ultimo, reference was made to my previous communication of the 13th of July last, on the subject of the Ordnance Survey, and I was requested to inform your Lordships as to which of the undermentioned scales I would recommend, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made, viz.:

- 1st. A scale of 24 inches to the mile for rural, and of 10 feet to the mile for town districts.
- 2d. A scale of three chains to the inch, or $26\frac{2}{3}$ inches to the mile for rural, and of 10 feet for town districts; or,
- 3d. Scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped, *i.e.* the scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{5000}$ for towns, as recommended by the Statistical Society of London and the Statistical Conference at Brussels; those being the fractions now in general use on the Continent of Europe, and nearly equivalent to the scales of 2 feet $1\frac{1}{3}$ inch to the mile for rural districts, and 10 feet $6\frac{2}{3}$ inches to the mile for towns.

And further, that I would state my opinion whether the adoption of these decimal scales would be productive of any practical inconvenience.

In reply, I beg leave to acquaint your Lordships that I am of opinion, that either of the scales in question will be large enough for all the purposes for which

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Replies in favour
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estate surveys of rural districts are required, but that inasmuch as the third or decimal scale is compatible with any limit of measurement, and is that which can be made available for general purposes in the event of the decimal system being generally adopted, it appears to me to be the one that would eventually be found the most useful, and that it is likewise a scale that may be adopted without practical inconvenience.

No. 65.

MR. JAMES SAUNDERS, LAND SURVEYOR, &c.

Oxford, February 22, 1854.

I have the honour to acknowledge the receipt of your letter on the subject of the scale to be adopted for the map of the Ordnance Survey of this kingdom.

The subject being one of moment, and in which I take great interest, I have felt it my duty to give it the fullest consideration prior to submitting my reply.

In order to secure a map "comprehending all the objects" for which maps are usually made and required, from which areas may be readily and accurately computed, and on which, as occasion may require, alterations made on the ground may be accurately plotted. Its scale, in my opinion, ought to comprehend the *four following essential points* (that is to say)

First. For rural districts, the scale ought *not on any account* to be less than the common plotting scale of three chains to one inch, (unless it be intended to plot all villages and patches of buildings to a larger scale.)

For town districts, it ought not to be less than one chain to an inch, (equal to six feet eight inches to the mile.)

Secondly. The unit of the scale *ought to* be some well-known measure of length, such as an inch, foot, or yard, which ought also to be decimally divided into parts or chains that it may at any future time be made the decimal standard of length in this country, and also assimilate with Continental standards of length (which by-the-bye do not coincide in any two Countries.)

Thirdly. The scale ought to bear a definite numerical proportion to the linear measurement of the ground; the denominator of the proportion being capable of easy decimal division; as 2,500 or 2,200.

Fourthly. It ought to be a scale, the *area of the square* of whose unit gives a result capable of perfect decimal division; as 100 or 1,000.

I will now point out how far the three scales mentioned in your letter respectively comply with these essential points.

I. With respect to the first scale mentioned—that of 24 inches to the mile.

First. I think it too small either to show with clearness or accuracy the details of intricate and minute work, or to admit of accuracy and expedition in plotting and scaling.

Secondly. When reduced to its unit (the inch) its parts or chains *do not* give a result capable of decimal division, as it gives 3.333 to the inch.

But as regards feet, yards, and miles, the results are more satisfactory, for they are 40 chains to a foot; 120 chains to a yard; 211,200 chains to a mile.

Thirdly. Its numerical proportion to the linear measurement of the ground is 1 in 2,640.

Its denominator, therefore, *is not* a number easily reduced to a decimal.

Fourthly. The area of the square of its unit (the inch) is 11,108, and therefore *is not* a result capable of perfect decimal division.

The areas, however, of the foot and yard give more satisfactory results, they being 1,600 chains to the square foot; 14,400 to the square yard.

II. With respect to the second scale mentioned, that of three chains to an inch (or $26\frac{2}{3}$ inches to a mile), this scale is and has for many years past been in general use for plotting accurate rural surveys, and is that on which a very large majority of original maps have been constructed, and from which reduced maps have been made to illustrate deeds and public documents, though the quantities set forth therein have for the most part been computed from such three-chain maps. Moreover, it is the scale to which most of the first class maps made under the General Tithe Commutation and Inclosure Acts have been plotted.

First then, as to its size, it is, as I have before stated, in my opinion the *minimum* scale which can be adopted to secure successfully the objects required. Replies in favour of the Decimal Scales.

Secondly. When reduced to its unit (the inch), or to a foot or yard, its parts or chains *do not* give results capable of easy decimal division, for they are—

Chains.
3 to an inch,
36 to a foot,
108 to a yard.

Thirdly. Its numerical proportion to the linear measurement of the ground is 1 in 2,376.

Its denominator, therefore, is a number *not* easily reduced to a decimal

Fourthly. The areas of the square of its unit, whether they are considered in inches, feet, or yards, *do not* give results capable of perfect decimal division, for they are—

Chains.
900 to a square inch,
129,600 to a square foot,
1,166,400 to a square yard.

III. With respect to the third scale mentioned, that of 1 in 2,500,

First. As to its size, it is like the 24-inch scale, (but not to so great a degree,) *too small* either to show with clearness and accuracy the details of intricate and minute work, (unless by enlargements,) or to admit of accuracy and expedition in plotting and scaling.

Secondly. When reduced to the ordinary units, whether inch, foot, or yard, the results *are not* capable of decimal division, for they are—

Chains.
3,156 to the inch,
37,879 to the foot,
113,636 to the yard.

Thirdly. Its numerical proportion to the linear measurement of the ground is 1 in 2,500.

Its denominator, therefore, *is easily* reducible to decimals.

Fourthly. The areas of the squares of its units, whether in inches, feet, or yards, *do not* give results capable of decimal division, as they are—

Chains.
996 to a square inch,
143,474 to a square foot,
1,291,314 to a square yard.

As therefore, neither of these scales possesses more than *one* of the points which I consider absolutely essential, I take the liberty of suggesting to your Lordships a scale which I think will be found to combine all these points in a satisfactory manner.

Starting upon the fact that the only unit or standard of extension in this realm is a yard (see 5 George IV. cap. 74); and that the land chain of 22 yards' length is the instrument by which all measurements for surveys are taken, and that it is already decimally divided into links; also that 10 square chains make one statute acre, (which measure Mr. Biddle, in his evidence before the Commons' Committee, in 1841, I think satisfactorily showed could never be altered without producing great practical inconvenience and immense confusion in the title deeds of estates, &c., &c.,) I beg leave to suggest that the *imperial standard yard* be adopted as the unit of the proposed scale, and that it be divided into 100 parts, or chains, each such part to be subdivided into 10 parts, representing 10 links each. Thus a perfect decimal scale will be established upon the *only standard unit* of the realm.

Now, with respect to the four points which I think are absolutely essential in the scale of a map, it will be seen that—

First. As regards size, the scale I propose would be *rather larger* than either of those mentioned, for it will give 2.77 chains to an inch, which is equal to 333.33 chains to a foot, and equal to 28.80 inches to a mile.

From the clearness of its graduations, and consequently the facility it affords in reading off, it is much better adapted for general use than the ordinary plotting scale of three chains to an inch; and while it by no means leads to the production of an unwieldy map, it shows with great perspicuity very minute details, and admits of very small dimensions being plotted without exaggeration, which is not the case with smaller scales.

Secondly. Its unit, the yard being divided into 100 parts, (as above explained,) it is already decimalized, for 100 chains to the yard give, necessarily 10,000 links to the yard.

Thirdly. Its numerical proportion to the linear measurement of the ground is 1 in 2,200.

Its denominator, therefore, is a number of easy decimal reduction. Perhaps I may here remark, that the very relation of this natural proportion (1 in 2,200) gives to this scale a most useful practical property for all purposes connected with land surveying and lineal admeasurements, viz., that from the fact of 2,200 chains' length in the field being represented by one chain's (or 22 yards) actual length on the paper, every 22 chains' length in the field will be represented by *one link's* actual length on the paper.

Fourthly. The area of the square of its unit gives a result capable of perfect decimal division, for every square yard will contain exactly 1,000 square acres.

I cannot, therefore, but think, that by adopting this scale (the yard decimalized) it will be found to combine greater advantages than any other scale. I take the liberty also of pointing out, that if the only standard unit (the yard) were thus decimalized, it would establish at once in this country a perfect decimal system of lineal measurement upon the only legalized unit of extension, and therefore, on *the only safe basis* by which our acknowledged measures of length might, with very few alterations, be adapted to a perfect decimal system.

Appended hereto, are tracings of a portion of a map plotted to these several scales, and also a table showing the comparative sizes of these scales.

As regards a scale for maps of *town districts*, I am of opinion, that on account of the multitude of purposes for which a town map will be made practically available—

Its scale, in the first place, ought to be such as will admit of the smallest dimensions being faithfully and expeditiously plotted. I mean dimensions as small even as one link, or 7.92 inches.

Secondly, It ought to be a scale which is *merely an enlargement* of the rural scale, say five times its size, so that the *same* scale may be used, either for the rural or town map, merely by a different reading, which might be marked also on the scale; and

Thirdly, I am of opinion that it ought to be a *pure decimal scale*, and have no reference whatever, to the present foot or inch, (for no doubt both feet and inches will shortly be obliterated from the list of measures of length.)

I therefore propose, in order to secure a scale for town districts possessing these advantages, to keep the *yard as the unit*, (as in the case of the rural scale,) and divide it into 20 parts or chains, each such part to be subdivided into 10 parts, (equal to 10 links each,) and again, each such subdivision to be graduated *into 10 parts*, each of which would represent *one link*.

On the rural scale, therefore, every five parts or chains, would be read as one chain, every one part or chain, as 20 links, and every 10 links as two links.

This gives a scale of one mile in 12 feet, therefore possessing the advantage of being rather larger than one mile in 10 feet.

I would also suggest that, on the measuring tape, the link be divided decimally into 10 parts. Inches need not then be entered in the field book.

No. 66.

GENERAL BOARD OF HEALTH.

Replies in favour
of the Decimal
Scales.

Whitehall, February 25, 1854.

I am directed by the General Board of Health to forward to you the enclosed report of Mr. Austin on the proposed scales of Ordnance Survey, as requested by you in your letter to the Board of the 16th ultimo.

I have, &c.,
(Signed) T. TAYLOR, Assistant Secretary.

PROPOSED SCALES OF THE ORDNANCE SURVEY.

To the General Board of Health.

MY LORD AND GENTLEMEN,

Having had the honour to receive the instructions of your Honourable Board for a further report on the subject of the Ordnance Survey, for your consideration with reference to the request of the Lords Commissioners of Her Majesty's Treasury, that you would inform their Lordships which of the scales mentioned in Sir C. Trevelyan's letter of the 16th ultimo you would recommend, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made, I have no hesitation in expressing an opinion very strongly in favour of the third proposition contained in that letter, namely, "Scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped, *i.e.* the scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns."

Your Honourable Board are aware, that this question was very fully considered when the duty devolved upon you of prescribing the scales for the plans to be prepared for the purposes of the Public Health Act. I would beg to quote the following passage on the subject from my report to your Honourable Board in 1849.

"While considering the importance of the adoption, at the present time, of general measures for town surveys, the opportunity which would be afforded for introducing the decimal scale should not be overlooked. This system is practised throughout nearly, if not quite, all other civilized countries. It possesses decided advantages in its simplicity of expression, which renders it more readily understood by the non-professional and the public generally; the facility of equal division is greater for enlargement or reduction, and it has a world-wide intelligence, the scales of England alone being unintelligible to other countries."

The same arguments which are urged in favour of a decimal coinage would, in fact, appear to apply with equal force to the adoption of a similar change in the present confused practice in this important branch of service.

The advantages of the proposed change were, I believe, fully appreciated at that time; but it was thought that as the Ordnance Survey department would be largely engaged in the preparation of the plans under the Public Health Act, and that these plans might be made to form an integral part of the national survey itself, considerable practical inconvenience might result by a complete departure from the established custom; and therefore it was then considered the best alternative to adopt a simple multiple of those scales.

Now that it is admitted, however, that the Ordnance scales are insufficient and that it becomes a question as to which scales can for the future be permanently adopted for the national survey, to comprehend all the objects which that great work would be intended to subserve, with the greatest facilities to all, I would earnestly submit in reply to their Lordships' question whether the adoption of these decimal scales would be productive of any practical inconvenience; that the temporary inconveniences and trouble which may arise, and which may fairly be expected in any change of so important a nature, should weigh as nothing in comparison with the difficulties which would be perpetuated by the maintenance of a complex and exclusive system which is behind the experience, on the subject, and the progress of other countries; and that, in adopting a great change like that which is contemplated, it would be matter of much regret that the apprehension of immediate inconvenience to the department should cause the proposed improvement to stop short of a principle which offers such lasting and material advantages.

(Signed) HENRY AUSTIN.

Replies in favour
of the Decimal
Scales.

No. 67.

MR. JAMES WALKER, F.R.S., CIVIL ENGINEER.

23, Great George Street, February 27, 1854.

Having, in a report dated 3rd January, 1843, and also in a subsequent report dated 24th February, 1854,* stated at some length my opinion of the scale which I think would be sufficiently large to comprehend the objects for which surveys and plans are required to be made for all but private property purposes, I shall in this confine myself to the comparison of the three scales referred to in your letter of the 16th January, 1854.

I beg therefore to state, that I consider the third scale in the list, viz. $\frac{1}{2500}$ of the ground to be mapped for rural, and $\frac{1}{500}$ for towns, as upon the whole the preferable.

No. 68.

LORD HATHERTON.

Teddesley, February 27, 1854.

On the receipt of your letter of the 16th of last month, respecting the best scale for an Ordnance Survey, I conferred with Mr. Taylor, Lord Ward's agent at Dudley, on the subject,—as I considered him from his extensive experience as a surveyor, in every description of country, not only in rural districts, but in towns,—and parts of the country most thickly occupied by mines, and works of every sort, and more closely intersected by canals and railroads than any other in England, as by far the best qualified person I knew to estimate correctly the scale best adapted to all the objects for which surveys are usually made.

I now beg to enclose a letter from him on the subject.

Enclosure in No. 68.

MR. GEORGE TAYLOR, LAND SURVEYOR, TO LORD HATHERTON.

MY LORD,

Dudley, February 25, 1854.

I greatly regret having so long delayed answering the Treasury circular of the 16th ultimo, but I have been anxious fully to consider the subject.

I think that it would be a great advantage to adopt the decimal scale for all maps, but if it is determined to make a map of England on a scale which shall be "sufficiently large to comprehend all the objects for which plans are usually made," the scale of $\frac{1}{2500}$ would be too small, and I would recommend a scale of $\frac{1}{2000}$.

In estate and parochial surveys, it has generally been considered that a scale of three chains to an inch, or $26\frac{2}{3}$ inches to a mile was quite small enough, and it has not been unusual to adopt a scale of two chains to an inch, or 40 inches to a mile.

I certainly think the map should not be on a less scale than $26\frac{2}{3}$ inches to a mile, and that it would be very advantageous to make it on a scale of $\frac{1}{2000}$, or about 32 inches to a mile.

I do not think that a better scale for towns than $\frac{1}{500}$ could be adopted.

I do not understand how any difficulty could arise from the adoption of the decimal scales.

I have, &c.
(Signed) G. TAYLOR.

* See page 333.

No. 69.

COLONEL GEORGE EVEREST, F.R.S.

10, Westbourne Street, Hyde Park,

February 28, 1854.

I have the honour to acknowledge the receipt of your letter of 16th January 1854.

The scales which you specify, viz. 24 inches, 10 feet, and $26\frac{2}{3}$ inches to the mile, are but other terms for the fractions, $\frac{1}{2640}$, $\frac{1}{528}$, and $\frac{1}{2376}$ of the linear measurements they represent. I am an advocate for simplifying all such matters, and have no hesitation in preferring the fractions $\frac{1}{500}$, and $\frac{1}{2500}$.

Every alteration must produce practical inconvenience to those who have been brought up, and have become habituated to particular systems and routines; but I do not apprehend that the adoption of the decimal fractions above alluded to can be of serious inconvenience in any quarter.

I believe those are the only points on which my opinion is desired in the present case, but I shall at all times be most happy to be of any service.

No. 70.

PROFESSOR FORBES, PRESIDENT OF THE GEOLOGICAL SOCIETY.

(See No. 36 at page 252.)

No. 71.

CAPTAIN JAMES VETCH, R.E.

London, February 27, 1854.

I have been duly honoured by your letter of the 16th January last, and by a previous communication of 20th April 1853, requesting my opinion as to the most convenient and useful scales on which to lay down national surveys,—in more general terms, the best relation to be established, to meet the various requirements of the public, between areas surveyed, and representations of the same on paper.

I have been desirous of offering such opinions as a long experience with the subject in all its bearings has enabled me to arrive at, and have only to regret that engagements did not permit me to comply with your requests long ere this time, and even now I have to apologise for the crude manner in which I have been compelled to treat so important a question.

The ratio of any area of ground to a standard square, being the same as the length of any line on that area, to a line equal to the side of the standard square, it will be more simple and convenient to treat the question as an affair of lines only.

It always occurred to me as a source of great confusion, trouble, and inconvenience, that a comprehensive system, based on fixed principles, had not been introduced at an early period, under the auspices of Government, and that in default thereof, individuals, and private parties, have used their own caprice, and thereby introduced for their particular purposes, such complex and numerous ratios (couched under so many denominations of measures) as to render comparisons between any two scales most difficult, whilst the different terms in which the scales are expressed, render it troublesome to form a clear idea of the proportion without calculation.

No one can fail to comprehend at once the ratio of 500 feet to 1 foot, and 1,000, 2,000, 4,000, 8,000 feet to one foot, as they are all commensurate and referred to one fixed standard, but we have scales now in use of 1 chain, and 2, 3, 4, 5, and 6, &c. chains to one inch, and, reversing the order of comparison, we have scales of 1 inch 2, 3, 4, 5, 6, 12, 20 &c. inches to one mile; in this latter case the measure on the ground is fixed and that of the scale variable, while in the first case the value of the scale is fixed, and the measurements are variable. Besides chains, and statute miles, as above mentioned, for expressing distances on the ground, we have feet, yards, furlongs, and geographic miles.

In trigonometrical surveys, and where very nice operations are required, as in measures of altitudes, the reduction of bases to the level of the sea, and the conversion of measured lines into arcs of great circles, the foot is the measure used; and if it be desirable and useful to translate the various denominations of ratios, and of measures, into the best known term, the foot is obviously that to be preferred. If the comparison of plans of different scales, and under different denominations of measures, be inconvenient and troublesome at home, the evil is much increased when we have to compare foreign plans with each other or with our own; and this question becomes the more important when we consider the different measures used in many of our colonies and distant territories.

The great inconvenience and confusion which exist through the arbitrary ratios and variety of measures in use, are the natural consequences of a want of fixed rules on the question, but the chaos which now exists, admits, in my opinion, of a very simple and satisfactory remedy.

There is no doubt that a series of scales is required to meet most suitably the various requirements, but the members of that series may be made commensurate, and may be expressed in the same denominations of measure; and such a series of scales may be selected as will admit of extension in either direction, and of being interpolated, so as to meet all required cases.

Taking into the account, also, the variety of measures in use in our colonies and distant territories, I would beg to recommend fixing the *principle and system of required scales on the most simple basis*, and capable of the most general application: the first step towards which, I conceive to be, that all dimensions in plan and scale should be expressed in feet, and decimals of a foot, and that the tenth part of a foot, (which for distinction's sake I would call a digit, or the digit of a foot) be the *standard of comparison on paper*. In this manner every other measure might be disused but the foot and its decimal parts; but so doing *does not preclude (but rather facilitates) the addition of scales to suit any other denomination of measure*, the thing measured and its representative on paper, *still holding the same ratio to each other*, and such a proposition may prove the more advisable, as the use of the decimal division is being extended to weights, measures, and coins, and is daily becoming more valuable from the cosmopolitan tendencies of the day which even aim, most wisely, at a common alphabet for all languages.

I have now to bring under consideration what has been proposed as the leading principle for universal application, viz. a definite and simple ratio between the measurement on the ground and its representation on paper, which every nation may easily understand, such simple ratio being always expressed on the scale by unity, as $\frac{1}{500}$, $\frac{1}{1000}$, $\frac{1}{2000}$, &c.

My opinion has been asked, whether I would recommend $\frac{1}{500}$ for a scale for towns, and $\frac{1}{2500}$ for rural districts:—I beg to say, that I consider $\frac{1}{500}$ as a very proper and useful ratio for the first or largest scale of a series to accommodate all requirements, and I would therefore recommend its adoption.

The next question to which I address myself is the construction of a series of scales which for convenience and simplicity should be commensurate with each other, and such a series, I conceive, ought to be on the most simple geometrical progression, by using the common multiple or divisor 2, as the case may be; but this principle prevents the adoption of the other proposed scale of $\frac{1}{2500}$, which, though a simple multiple of the other, does not permit of simple interpolation. I adopt the simple multiple 2, because it is the smallest simple multiple, and that which, while it provides a suitable scale for every required purpose, will not carry the series into too great a length, as all may probably be comprised in 12 scales, and of which several will be seldom used.

I have been asked also, whether one inch to a mile, or six inches to a mile, would be most useful for County purposes, and whether 24 inches to a mile, 60 inches to a mile, or 120 inches to a mile, would be most suitable for other requirements.

These have not a common multiple, and have the defect of making the scales of measures variable instead of a fixed unity, and if new scales are to be introduced not consistent with definite principles, and as members of a simple series, they will only further complicate a question, already too confused, and in such a case it may be better to adhere to the scales now in use than to introduce new ones.

I now beg to recapitulate some of the recommendations already made.

1st. As regards general principle, I approve of adopting a definite and simple proportion between the area measured and its representation on paper, the representation being expressed by unity, but it is essential to its utility that the proportion be in all cases distinctly stated on the plan, as $\frac{1}{1000}$ or $\frac{1}{2000}$, &c., and this done, any person may convert foreign measures and scales into English, or complicated English ratios into more simple ones; for instance, if we have a Russian map before us with a scale of versts to a Russian inch, but showing the ratio of the ground to the plan, say $\frac{1}{6400}$, in order to learn the distance on such map in English measures between two distinct points, it is merely necessary to measure the same with a foot rule and multiply the length so obtained on the map (which we may suppose to be in feet and decimals) by 6,400, and we obtain the distance in English feet, or a scale may at once be constructed in feet of 640 feet to one tenth of a foot.

I have recommended the foot to be the sole measure of length employed in constructing scales. Every country has its foot,* but scarcely any two are of the

Replies in favour
of the Decimal
Scales.

* "The Proportions which the Foot in the undermentioned Places bears to the Rhineland Foot when divided into 1,000 parts."—Tielke's Field Engineer, translated by Hewgill, London, 1789.

No.	Name.	Parts.	No.	Name.	Parts.
1	Rhineland foot	1,000	61	Hildesheim	892.7
2	Paris foot	1,035	62	Holstein	950.9
3	English standard	971.13	63	Inspruck	1,012
4	Geometrical foot†	985	64	Italy, geometrical	884.8
5	Alexandria	1,101.8	65	Konigsberg, ordinary	980.4
6	Amsterdam	904.2	66	" small	979.6
7	Anspach	948.7	67	Leyden	999
8	Antorf	909.2	68	Leipzig, mean	899.9
9	Antwerp	909.9	69	" large	1,004.1
10	Augsburg	943.7	70	Lyons	1,088.9
11	Basil	950.2	71	Lisbon, small	996.9
12	Bavaria	930	72	Louvaine	909.9
13	Berlin, common†	986.8	73	Lubeck and Luneburg	927.2
14	Bern	934.4	74	Liege	916.4
15	Besangon†	985.4	75	Magdeburg	903.4
16	Brabant	909.9	76	Manheim	924.3
17	Brunswick	909.2	77	Masson (Magon)	1,065.2
18	Bremen	925.7	78	Maestrick	894.8
19	Breslau	909.9	79	Mayence	959.5
20	Briel, large	1,068	80	Malines	890.5
21	small	1,060.1	81	Meeklenburg	927.2
22	Brussels	927.2	82	Mellen	889.9
23	Burgundy	1,087.4	83	Middleburg, large	960.2
24	Buxtehude	927.2	84	Moscow	1,065.9
25	Calenberg	930.7	85	Neufchatel	955.9
26	Castello†	985	86	Nurnberg	968.1
27	Castille	900.6	87	Oldenburg	943.7
28	China, field	1,018.5	88	Pomerania	930.8
29	" builder's	1,018.5	89	Prague	961.7
30	Cleves	941.5	90	Riga	873.3
31	Copenhagen	1,000	91	Rome, ancient	1,008.7
32	" small	933.6	92	" Vespasian	1,129.8
33	Cracow, small	1,106.9	93	" small, ancient	948.7
34	Danzig	916.4	94	" new	938.7
35	Dijon	1,000.5	95	Rotterdam	995.4
36	Dort, mean	1,049.4	96	Rouen	862.5
37	Dresden	916.4	97	Samos	1,102.5
38	Emden	943.7	98	Sweden	948.7
39	Erfurt	899.1	99	Switzerland	955.9
40	Eyderstadt	943.7	100	Sedan	88.4
41	Frankfort	920.7	101	Spain	900.6
42	Germany, old	1,049.3	102	Strasburg, country	940.8
43	" labourers'	907.8	103	Turin	1,029.2
44	Gibraltar	900.6	104	Ulm, large	970.2
45	Giessen	948.7	105	Urbano	1,128.4
46	Goes	955.2	106	Utrecht, large	869.7
47	Gotha	916.4	107	Venice	1,106.9
48	Goettingin	927.2	108	Verdun	927.2
49	Grenoble	1,086.7	109	Verona	1,106.9
50	Greece, large	1,042	110	Vienne	1,027.8
51	" mean	976.1	111	Vienna, small	1,006.2
52	" small	970.3	112	Wittenberg	902
53	Groeningen	930.8	113	Wurtemberg	937.2
54	Haag	1,035	114	Zelle	927.2
55	Halle	948.7	115	Zirikzee, large	988.9
56	Hamburg	912.8	116	" small	987.5
57	Hanover	930.8	117	Zurich, large	963.1
58	Harlem	910.6	118	" mean	956.7
59	Herforden	941.5	119	" small	955.9
60	Heidelberg	887.6			

† Inserted by Captain Vetch.

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same length, and perhaps some day we may see the hundredth part of a second of an arc on the equator established as a geographic or natural standard foot, or unit of lineal measure; this foot is equal to 1.01428 English feet; at present we have only to deal with the standard English foot, which I have endeavoured to show is the most useful of English measures to adopt as a standard for the scales of this Country.

For the elements of the system as proposed, we have:

1st. A direct and simple ratio between the measure on the ground and that on the plan; which last is expressed by unity.

2d. A regular series of scales, in geometrical progression, 2 being the common multiple.

3d. The adoption of the foot and its decimals, to the exclusion of other denominations of measures.

4th. For the constant of the scale $\frac{1}{10}$ or 1 digit of a foot to be adopted.

The first member of a series of scales is arbitrary, but it must govern the others, and the ratio of $\frac{1}{500}$ having been already proposed and admitted as a proper member of the series to begin with, the following series will arise:—

Scales.

1 expressed by $\frac{1}{500}$ or by 1 digit to 50 feet.			
2	"	$\frac{1}{1,000}$	100 "
3	"	$\frac{1}{2,000}$	200 "
4	"	$\frac{1}{4,000}$	400 "
5	"	$\frac{1}{8,000}$	800 "
6	"	$\frac{1}{16,000}$	1,600 "
7	"	$\frac{1}{32,000}$	3,200 "
8	"	$\frac{1}{64,000}$	6,400 "
9	"	$\frac{1}{128,000}$	12,800 "
10	"	$\frac{1}{256,000}$	25,600 "
11	"	$\frac{1}{512,000}$	51,200 "
12	"	$\frac{1}{1,024,000}$	102,400 "

The following Table will show the value of the above Ratios as compared with Scales now in use.

		Feet.	Chains.	Inches.	
1. $\frac{1}{500}$ or 1 digit to 50 feet		41.6 to 1 inch	0.63 to 1 inch or	126.72 to 1 mile	For plot of large Cities.
2. $\frac{1}{1000}$ " 100 "		83.3 " "	1.25 " "	63.36 " "	Engraved plans of large Cities.
3. $\frac{1}{2000}$ " 200 "		166.6 " "	2.5 " "	31.68 " "	Plot of Parishes and Manors.
4. $\frac{1}{4000}$ " 400 "		333.3 " "	5.05 " "	15.84 " "	Engraved plans of ditto.
5. $\frac{1}{8000}$ " 800 "		666.6 " "	10.1 " "	7.92 " "	Plot of Baronies, &c.
6. $\frac{1}{16000}$ " 1,600 "		1333.3 " "	20.2 " "	3.96 " "	Engraved plans of ditto.
7. $\frac{1}{32000}$ " 3,200 "		2666.6 " "	40.4 " "	2 nearly " "	Plot of Counties,
8. $\frac{1}{64000}$ " 6,400 "		5333.3 " "	80.8 " "	1 nearly " "	Engraved plans of ditto.
9. $\frac{1}{128000}$ " 12,800 "		10666.6 " "	- " "	- " "	Provinces about 2 miles to 1 inch
10. $\frac{1}{256000}$ " 25,600 "		21333.3 " "	- " "	- " "	{ Kingdoms or Principalities.
					{ About 4 miles to 1 inch.
11. $\frac{1}{512000}$ " 51,200 "		42666.6 " "	- " "	- " "	About 8 " "
12. $\frac{1}{1024000}$ " 102,400 "		85333.3 " "	- " "	- " "	About 16 " "

If such a system were approved of by Government it would shortly become of general application; for Government and Parliamentary purposes the same might be enforced; and the convenience derived by the adoption would soon be appreciated and acted upon for general purposes.

With the Table just submitted, if I am asked what scale I would recommend for publication of plans for large cities, I would prefer No. 2; if for parishes and rural districts I would prefer No. 4; for baronies, No. 5; for counties, No. 8; but I conceive these ought to be plotted to No. 7; but this or any other scale for plot must depend on requirements of which I cannot be fully aware of.

I have to apologize for this delayed, and yet hasty, expression of the opinions I entertain on this very important subject.

No. 72.

MR. E. H. J. CRAUFURD, M.P.

2, Paper Buildings, Temple, February 28, 1854.

In answer to your communication of the 16th ult., on the subject of the Ordnance Survey, I beg to inform the Lords Commissioners of Her Majesty's

Treasury that after a careful consideration of the subject, I would recommend the adoption of the decimal scales set out in your letter above referred to.

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Scales.

I can see no practical inconvenience that could arise from the adoption of these decimal scales. On the contrary, I think it would prove highly beneficial in forwarding the early adoption of the decimal system in all our weights and measures.

The only objection which I could urge is to the particular fraction proposed for rural districts. I think that it will not be sufficiently large to comprehend all the objects for which surveys and plans may be required, and that it will be of little or no use in the case of lands parcelled out for building plots; as for instance in the neighbourhood of large towns, or round many of the railway stations throughout the country. But probably this objection could be obviated by requiring all building plots to be mapped on the scale proposed for towns.

No. 73.

COPYHOLD, INCLOSURE, AND TITHE COMMISSIONERS.

7, Whitehall Gardens, February 28, 1854.

In reply to your circular of the 16th January, 1854, we beg to state, in the expectation of a decimal system being likely to be adopted, that we are of opinion that a scale of $\frac{1}{2500}$ is, for rural districts, the best numerical proportion to the linear measurement of the ground to be mapped; $\frac{1}{3000}$ or $\frac{1}{2000}$ would be a more simple proportion, but the first would we think give a plan too small for an accurate delineation of internal quantities, and the other a plan unnecessarily large.

Gunter's chain being already decimalised, and no quantity less than a link taken account of, no difficulty will arise from the adoption of the $\frac{1}{2500}$ scale; but on the contrary, it will assimilate the practice of mapping to the principle of measurement, as the decimal (rule) scale will then be used instead of the foot rule divided into 36 parts.

It is important to observe that surveyors, so far as we are informed, anticipate no difficulty whatever in the proposed scheme of adopting the proportion of $\frac{1}{2500}$.

As regards towns there may be more difficulty. Ground in such cases is almost universally measured by the foot, and so described in leases and conveyances; and we are not prepared to express any decided opinion on this head, but would suggest that, if the $\frac{1}{3000}$ proportion be adopted, there should not only be a decimal, but a foot scale on the plan.

It is also very desirable that there should be engraved on all maps scales of the existing units of measure, having reference to all purposes for which the maps may be made available.

(Signed) WILLIAM BLAMIRE, }
G. DARBY, } Commissioners.
H. C. MILES, }

No. 74.

MR. WILLIAM HAYWOOD, CIVIL ENGINEER.

14, Old Jewry Chambers, February 28, 1854.

In answer to the communication, requesting my opinion as to the scales which may be most advantageously adopted for the Ordnance Plans, I beg to state that although at first some slight inconvenience may be felt by the introduction of the scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped—that ultimately their convenience would be very great—and that their adoption for the national plans will be found to have been most judicious, should a decimal system of measures be adopted at some future day in this country, and the rudimentary unit of length be altered; for the scales of proportion, being irrespective of any unit of length, are therefore universally applicable

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Scales.

If it should be determined not to adopt these scales, I consider the next most suitable to be the three-chain scale for the suburban districts, and that some regular proportion to that scale should be adopted for the urban areas, either four times equal to 8 feet $10\frac{2}{3}$ inches in a mile, or five times, equal to 11 feet $1\frac{1}{3}$ inches to a mile.

No. 75.

MR. J. HILL WILLIAMS, ACTUARY.

London, 12, Waterloo Place, February 28, 1854.

In answer to your letter of the 16th of January, on the subject of the proper scales for the Ordnance maps, I beg leave to communicate my opinion, formed after much consideration, in favour of the third set of scales enumerated in your letter, viz., those bearing a definite numerical proportion to the linear measurement of the ground to be mapped, say $\frac{1}{2500}$ for rural districts and $\frac{1}{500}$ for towns, as recommended by the Statistical Conference of Brussels. I cannot foresee any practical inconvenience as likely to arise from their introduction, but on the contrary I anticipate that it would be followed by numerous advantages resulting from the perfect uniformity of the system, and the universal character of the proposed scales.

The greatest benefit however, to be derived from their adoption appears to me to depend on their decimal character, or rather on their capacity for future adaptation to any decimal system of measures that may be hereafter introduced—no matter what may be the basis selected for that system, or how the existing standards may be affected by the alteration. The adoption of any other arbitrary scales at the present time, when the public mind has all but decided on the necessity of a decimal system of weights, measures and coinage, would be, I apprehend, to create a new and uncalled-for barrier to future improvement, while the proportional scale, as it may be called, possesses this decided advantage over all others, that it is independent of all arbitrary standards, and perfectly compatible with the existing linear measures, should the Government be discouraged by the temporary difficulties that must attend all change, from introducing a complete decimal system adapted to the growing wants of a scientific and commercial people.

No. 76.

MR. HENRY LAKIN, LAND SURVEYOR, &c.

(See No. 38, at page 250.)

No. 77.

METROPOLITAN COMMISSIONERS OF SEWERS.

1, Greek Street, Soho, March 2, 1854.

In reply to your circular letter of the 16th January, I am directed by the Metropolitan Commissioners of Sewers to state to you, for the information of the Lords Commissioners of Her Majesty's Treasury, that the Commissioners of Sewers having considered the subject referred to them for their opinion, have come to the conclusion that, of the several scales for the Ordnance Survey therein specified, those recommended by the Statistical Society of London, and the Statistical Conference at Brussels, namely: the scales of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns, are to be preferred to either of the other scales mentioned in the circular.

The reasons for this preference are, that the scales in question are wholly independent of any conventional standard of measure; that they accord with a system extensively adopted in other countries, and are at once intelligible to

those who are unacquainted with the standards of measure in this country, and that they will adapt themselves to any alterations of those standards which may hereafter be effected.

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of the Decimal
Scales.

As the ordinary process of printing causes the paper to shrink, thereby affecting the accuracy of the scale on impressions of engraved maps, the Commissioners of Sewers would suggest the desirableness, in all cases where Ordnance maps are engraved, of engraving the scale in the margin of every sheet, and thus of securing the means of correcting the error arising from this cause, by a comparison of the scale on the printed copy with a similar scale on a substance which has not shrunk.

I am directed to add, that the Commissioners of Sewers consider that, when fully brought into use, no practical inconvenience can result from the adoption of the decimal scales above referred to.

I have, &c.
(Signed) E. H. WOOLRYCH, Secretary.

No. 78.

MR. W. E. GAINE, LAND SURVEYOR, &c.

RECOMMENDED.

	Scales.
For draft plans of rural districts - - -	$\frac{1}{2500}$
For draft plans of towns - - -	$\frac{1}{500}$

SPECIAL OBSERVATIONS.

4, Harewood Street, Harewood Square, February 20, 1854.

In reply to the Treasury circular, bearing date the 16th January, which I had the honour to receive, I beg leave to observe, that in my communication of October 1853, on the Ordnance Surveys, I there recommended a scale of 24 inches to the mile for rural districts, and 10 feet to the mile for town surveys—my principal reason for preferring the 24 inches to the mile to the $26\frac{2}{3}$ inches to the mile, or, as it is more usually known, the three chains to the inch scale, being, that it was a uniform multiple of the scale already in use by the Ordnance, and sufficiently large to answer all the purposes fulfilled by the three-chain scale.

But as the recommendation of the Statistical Society to have scales bearing a definite proportion to the linear measurement of the ground mapped, is more consistent and practical than the course we have hitherto pursued—that of representing one arbitrary measurement by another—and as the scales propounded are large enough to meet all the requirements of a national survey, I concur in the justness and desirability of adopting their views.

The practice of laying down mechanical drawings to a half, quarter, eighth, or sixteenth of the natural size, has never, I believe, been attended with practical inconvenience, neither would it have that effect as far as I can judge, should the same principle be applied to surveys, and the scales of $\frac{1}{2500}$ and $\frac{1}{500}$ be adopted; on the contrary, a great facility would be afforded of making use of any of the arbitrary measurements now in use, either of our own or the continental nations; and should our present standard of measurements, at some future period, be altered to a decimal one, the plans so laid down would not be affected by the change, whereas otherwise they would, if not in a direct proportion to the linear measurement of the ground mapped.

MR. HENRY WARBURTON, F.R.S.

45, Cadogan Place, March 23d, 1854.

I am honoured by your letter of the 15th of February 1854, requesting me to inform the Lords Commissioners of Her Majesty's Treasury which of the therein-mentioned scales I would recommend for the Ordnance Survey, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made :

And the scales above referred to, when reduced to a common standard are :—

I. For Rural Districts ;

- 1st. A scale of 24 inches to the mile ;
- 2d. A scale of $26\frac{2}{3}$ inches to the mile ;
- 3d. A scale of $25\frac{344}{1000}$ inches to the mile.

And II. for Town Districts :

Three scales the respective quintuples of the three preceding.

And I am also requested to state my opinion whether the adoption of the above mentioned third scale and of its quintuple, when expressed in decimal parts of the corresponding actual horizontal rectilinear distance, would be productive of any practical inconvenience.

To which inquiries I have the honour to reply as follows :—

I.—RURAL DISTRICTS.

Of all the purposes for which a national survey and public map are required, the registration of assurances and transfer of lands appear to me by far the most important.

At the instance of the Committee of the Lords on the Burthens affecting Real Property, 1846, the Crown appointed a Commission to consider the questions of registration and conveyance, over which Commission the late Lord Langdale presided.

This Commission in their Report, 1850, recommended “a system of “Registration as tending to render the title to real property secure, and the “means of transfer cheap and expeditious,”* and they were of opinion, “that “the use of public maps would lessen expense in the investigation of title, “and conduce to conciseness as well as precision in conveyancing.”†

They suggested ‡ that a careful examination should be made by competent persons of the existing maps, prepared under the Tithe Commutation and Parochial Assessment Acts, &c., in order to ascertain how far those maps could be adapted, by revision, to the purposes of registration ; and they recommended also, that inquiry should be made, by what means maps, on a *proper* scale, might be completed, first, for any district where the existing maps were insufficient, and ultimately, for the whole kingdom ; and they hoped that the expense of revising the existing maps, and of forming new maps for the residue of England, would be inconsiderable as compared with the advantages to the community to be derived from a system of Registration.

The existing Tithe maps have been examined by those highly competent judges, Lieut.-Col. Tucker§ and Captain Gosset ;|| and the result of their examination has been, not to confirm the hopes of the Commission, but to justify the doubts and misgivings expressed by Lord Langdale, in his letter to the Lords of the Treasury, of the 30th November, 1848, ¶ as to the

* Report of Commission on Registration. p. 21.

† Report. p. 19.

‡ Report. p. p. 21 & 25.

§ Correspondence, p. 215.

|| Correspondence, p. 222 ; and on the subject of the Tithe-Maps, see also Col. Colby's Report, dated May 6, 1840, Correspondence, p. 8 ; also in Appendix to Report of Registration Commission, Captain Yolland's Evidence, Questions 1742 and 1894 ; also Evidence appended to the Report of the Committee of the Commons, 1837, on Tithe Commutation maps.

¶ See full abstract of the Letter, in Appendix to Report of the Committee of the Commons on Ordnance Survey (Scotland) ; Question 1423.

worthiness of those maps as materials for constructing a general map for Registration purposes. It is due to the Tithe Commissioners and to their consultee, Colonel Dawson, to observe, that they are not chargeable with the defects of the existing Tithe maps; since, in 1837, before a Committee of the Commons, of which Committee I was a member, they gave full warning that the maps, prepared under the direction and at the expense of the parishes, were and would be very inaccurate. The country is now reminded of the penalty it incurred by not placing, at that time, the direction of the requisite parochial surveys in the hands of the Ordnance. There are no public maps existing, or next to none, of an accuracy and on a scale sufficient for a system of Registration.

What was in the judgment of Lord Langdale's commission a proper scale for the proposed public map, was not expressly stated in the report; but it may be inferred, from the scale of the existing maps, which they hoped might be found available for registration purposes.* The respective numbers of the first-class and second-class tithe maps were, as they stated, 1,887 and 9,622. In the evidence appended to the report, Colonel Dawson informs the Commissioner† that the first-class maps are drawn, for the most part, to the scale of $26\frac{2}{3}$ inches, and none below the scale of 20 inches to the mile: that for identifying boundaries, in case boundaries were changed, none but maps of great accuracy and on a large scale, would be sufficient. First-class tithe maps would, he thought, be sufficient to determine, in an agricultural district, a difference in boundary of two or three feet; perhaps, of two feet; about 1,000 of the second-class tithe maps were drawn to the same scales as the first-class maps. Hence it may be inferred that the scale which, in the judgment of the Commission, was a proper scale for the general map of the whole kingdom, to be applied to registration purposes, was a scale of $26\frac{2}{3}$ inches to the mile, or thereabouts; and inquiries which I have made, lead me to believe that I have not misinterpreted the views of the Commission.

That a scale of $26\frac{2}{3}$ inches, or thereabouts, is the proper scale for a map wherewith to identify lands in cultivated rural districts, may, I think, be safely concluded:

1st. Because it is the result of very extensive experience in England and on the continent of Europe:

2d. For reasons which may be assigned to account for that result.

First, as regards experience;

The scale of $26\frac{2}{3}$ inches is the scale which is preferred for ordinary estate maps by the persons practically conversant with the management of land in the rural districts of England. The scale of 20 inches is considered as barely sufficient for that purpose.

The Copyhold and Tithe Commissioners, in the maps prepared for the objects which they are appointed to promote, and also in the maps prepared by their advice for the purpose of parochial assessment, always recommend the adoption of the scale of $26\frac{2}{3}$ inches; and they are of opinion that, in no event, ought the scale for registration purposes to be less than that of 24 inches to the mile.

The territorial surveys of their respective countries, made in the course of the present century by the Governments of many different nations in Europe, are all drawn to the scale of $25\frac{34}{1000}$ inches to the mile, a scale about five per cent. less than that of $26\frac{2}{3}$ inches; and the uses which are made of public maps in the countries which have been so surveyed, establish the fact, that the scale of $25\frac{34}{1000}$ inches to the mile, is well adapted to the identification of lands in cultivated rural districts.‡

From the preceding examples I conclude, that it is not the precise dimension, but the *whereabouts* of the scale, that is the matter of primary importance.

Secondly, as to the reason which may be assigned to account for the result that in cultivated rural districts in different countries, a scale of $26\frac{2}{3}$ inches to the mile, or thereabouts, has been found by experience, to be the proper scale of a public map for identifying lands.

* Report of Commission on Registration, p. 21.

† Appendix to Report of Commission on Registration; Col. Dawson's Evidence, Questions, 1384, 1385, 1386, 1392.

‡ See Examples of the maps used in Belgium, in Appendix to Report of Commission on Registration.

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In the scale is involved the consideration of the magnitude of the horizontal distance to be represented, as compared with the magnitude of its linear representation. It is an essential prerequisite for an estate map, that it exhibit distinctly and measurably* the breadth of the narrowest strip of land which, as property, is worth consideration. This breadth is constantly undergoing diminution as cultivation advances and becomes more refined, as may be seen in the continual contraction of the pieces of waste land which adjoin boundaries. The breadth of this strip of land may be taken at about two feet. On the other hand, in order not needlessly to enlarge the dimensions of the map, the representation of this breadth should be the shortest line, the extremities of which can be seen separated the one from the other by a distinct interval. This line will by most persons be found to be about $\frac{1}{100}$ th of an inch. The scale derived from these data is $\frac{1}{24} \times \frac{1}{100}$; that is to say, the representation is the $\frac{1}{2400}$ th part of the horizontal distance represented, a result intermediate between the two scales of $26\frac{2}{3}$ inches and $25\frac{344}{1000}$ inches to the mile; the former corresponding to the $\frac{1}{2376}$ th part, the latter to the $\frac{1}{2500}$ th part of the horizontal distance. The scale of 24 inches to the mile corresponds to the $\frac{1}{2640}$ th part of the horizontal distance; and for practical purposes, the *whereabouts* of all these scales may be considered as the same. The constant improvement which is taking place in agriculture shows that the scale ought to go beyond, not to fall short of, present requirements.

The question next to be considered is, whether there is any one of the scales, not greater than $\frac{1}{2376}$, nor less than $\frac{1}{2640}$, that deserves to be preferred to the rest of the scales not lying without those two limits.

And first, as to the limits, $\frac{1}{2376}$ and $\frac{1}{2640}$; they appear to have been selected for scales by land surveyors, for the reason that a square inch, upon a map drawn according to the former scale, is $\frac{9}{10}$ ths of an acre, and upon a map drawn according to the latter scale is $\frac{10}{9}$ ths of an acre; so that by measuring upon a map how many square inches the representation of any piece of land contains, the acreage is determined, in the former case by deducting $\frac{1}{10}$ th from, in the latter case by adding $\frac{1}{9}$ th to, the number of square inches. I think, however, that it is injudicious to select, for the ratio between the representation of horizontal rectilinear distance and the distance itself, so very complex a ratio as that, either of 1 to 2376, or of 1 to 2640, with the view of obtaining simplicity in the ratio between square inches and acreage;† and that the judicious course is to render the ratio between the linear magnitudes, within the prescribed limits, as simple as possible, leaving the ratio complex, if necessary, between the corresponding areas.

For, to a person consulting a map or plan, the first point respecting it which, with a view to its clear comprehension, he usually endeavours to ascertain is, what is the ratio of the linear magnitudes, not of the corresponding superficial ones; and the simpler the ratio is between the linear magnitudes concerned, the clearer his conception is of the position of the objects represented.

Further, as regards the computation of acreage, it is almost a matter of indifference whether the ratio between a square inch on the map and the corresponding area of the ground, as projected on the horizontal plane, be a complex or a simple ratio. For, since an area is of two dimensions, and since each dimension would, in the majority of cases, be expressed by an integer together with a fractional remainder, the multiplication of these two improper fractions, the one by the other, would, to economise labour in computing, be performed, almost universally, either by a logarithmic process, or by the sliding rule. In either case, the labour of computing would be the same, whether the ratio of square inches to acreage were simple or complex.

The two scales of $\frac{1}{2376}$ and of $\frac{1}{2640}$ ought to be regarded only as ingenious devices for lessening the inconvenience arising from the complex relations which subsist between our measures of length and surface. To propose either of these scales as the basis for a comprehensive national survey, would not occur to a person in any country where such measures were not in use. Law or

* Say to the eye, aided by a very low magnifier, and to the hand, aided by a pair of common compasses.

† The ratio between the areas would be the simplest possible, if one square inch represented an acre exactly, when the ratio of linear magnitudes would be, $8 \times \sqrt{10} = 25\frac{2932}{100000}$ inches to the mile.

custom may alter these standards; but the proper ratio which ought to subsist between the sign of distance and the distance signified, in a survey destined for registration purposes, and to last for many generations, should be determined, not with reference to the measures in use at any particular period, but on grounds applicable to every country and time.

Respecting the other scales lying within the above stated limits, and not far removed from $\frac{1}{2400}$, I beg to remark, 1st, that the scale of $\frac{1}{2500}$ or $\frac{4}{10,000}$, i.e. '0004, is worthy of decided preference, because it is expressed by a single digit, 4; and is, on that account, so easy to remember, and so well adapted to computation.

2ndly. That in constructing the map, the adoption of this scale will save some labour in computing. For, referring to the process of constructing the Ordnance maps, as described by Colonel Colby in his report, 6th May 1840,* I consider that in reducing the chained lengths of the detail survey in the proportion of the scale, preparatory to drawing the field-plans, direct multiplication of those lengths by '0004 will be a simpler process than either the direct division of them by 2376, or 2640, or by the denominator corresponding to any other scale taken within the prescribed limits: or than a computation of the products of the chained lengths multiplied by '0004, or by any other scale, such computation being made according either to the logarithmic or logometric method. This saving of labour would, however, be effected only on the supposition that all lengths whatever, whether in the triangulation, or in the detail survey, or in the reductions made for the laying down on copper, are both measured and expressed in terms of one and the same linear unit, and of the decimal parts of that unit; which rule, I believe, is actually observed in the Ordnance surveys, so far as I can judge from Colonel Colby's report above cited, by expressing all lengths in terms of the foot.

3dly. That in using the map, when constructed, for the purpose of determining the horizontal distance between any two points from their measured distance on the map, it will be a simpler process, I conceive, to multiply by 10,000, and then divide by 4, than to multiply by 2376, or 2640, or other more or less complex factor than either of them, such factor corresponding to a scale taken within the assigned limits. If, however, corrections be applied to allow for the contraction or expansion of the paper, and if in that case logarithmic computations are thought advisable, all scales will then stand on a footing of equality.

4thly. In considering the claims of the scales, $\frac{1}{2376}$ and $\frac{1}{2640}$ to a preference, I have discussed the question of the advantage that any scale would have, as regards the computation of areas from measurements on the map; and I need not repeat my former observations.

5thly. That they are some of the most civilized and highly instructed and intelligent nations in the world who have been our precursors in making territorial surveys, with a view to apply those surveys to most important social purposes. The scale of those surveys is one of the fittest that can be selected for the purpose of identifying land. Less wealthy, many of those nations, than this country, they have persevered, unto completion, with these great and costly undertakings. It will not be becoming in us to vary from their model on light grounds, and least of all on the score of economy. I have studied with care the evidence given by Captain Yolland before the Registration Commission,† and the correspondence of Lieut.-Col. Hall and other officers of the Ordnance department, recently printed; and concurring with them, as I do, in all their observations on every point but that of the scale, and admiring as I do, their intelligence and sagacity, and the accuracy and precision of their knowledge on the matters under discussion, yet on the question of the scale I can discover no solid grounds for the conclusion at which they arrive in favour of a 12-inch scale, except that it will be attended with economy.

For the reasons alleged, I recommend, for Rural districts, a scale of four parts in 10,000, in preference to the other scales; and I recommend the constructing of a map on such a scale, subject to the following reservations:

* Correspondence, p. 5.

† Appendix to Report of Registration Commission, Questions 1647, 1661, 1705, 1903, 1907, 2214.

Replies in favour
of the Decimal
Scales.

Considering the magnitude of the objects to be attained by a public map, as set forth by Lord Langdale's Commission, the Survey, once decided on, should be undertaken with an energy, and carried on with a determination and perseverance that would insure its completion in a definite term of years. The annual fund supplied for the purpose should be proportioned to the term assigned, and ought not to be subject to a variation from year to year.

In every step of its progress, from the commencement to the completion of its several parts, the survey should be conducted on a system that will render it consistent with itself,* both as a whole, and in detail, and will ensure its accuracy and truthfulness; and the measures taken to secure authenticity in the results should be commensurate to the importance of the proposed social ends. Not only the triangulation, but the detail survey and the drawing of the field plans, must be unimpeachable for veraciousness, as well from the principle upon which the work is executed and paid for,† as from the severity of the examination which it undergoes after execution. It is from the accuracy of the details, as regards the property with which they are themselves concerned, that individuals will judge of the authority due to the survey.

The expansion and contraction to which paper is liable (to say nothing of its perishable nature‡) forbid the notion of making the original of the map on paper; for in that case, both the original and all copies made therefrom, whether on copper or on paper, would be inaccurate. The map, to be fiducial and authoritative, must be drawn on copper, in the way described by Colonel Colby,§ the field-plans being transferred to the copper by tracing. The impressions on paper from the copper will then be fac-similes of the original, and of one another.|| If then the original, in order to its accuracy and authenticity, must necessarily be on copper, all notion of having a second copper plate of half-size, must, I think, fall to the ground.¶

Unless the map, after the completion of its several parts, were undergoing constant revision, it would soon become obsolete, and unfit for registration purposes.** Except on condition of its being maintained *au courant* of the state of the actual face of the country, I think it ought not to be constructed at all.

My recommendation is (to use the words of Sir John Newport, before the Committee on the Townland Survey, 1824), that the survey "be committed entirely to the Board of Ordnance, with a view to effecting its speedy, "accurate, economical, and perfect completion."

I have considered the national survey only in the relation it bears to one great purpose—that of registration. If the scale of the map is sufficiently large for that purpose, it will be sufficiently large for every other purpose, requiring a map on an extensive scale.

It is not because I undervalue the importance of the other purposes, that I have passed them over without notice; for I consider them as sufficiently

* Maps of coterminous parishes, upon the same scale, produced before the committee of the Commons on the Tithe-Commutation Maps, 1837, were in no instance found to fit in those parts of the several maps where there was a common boundary. See also Captain Yolland's Evidence before the Registration Commission, Question 1742.

† See the Evidence of Col. Colby before the Committee on the Townland Survey, 1824, p. 27, on the inaccuracy of the work done in the Ordnance Survey of England by temporary surveyors. See also his statement in Report, May 6, 1840, Correspondence, p. 3, on contract work. See also Evidence of Captain Yolland, Appendix to Report on Registration Commission, 1850; Questions 1742, 1925.

‡ See the account of the state of the Down survey, partly damaged and destroyed by fire; partly injured by taking tracings, partly carried away to France. Evidence of John Wilson Croker, Esq., before the Committee of House of Commons on Townland Survey of Ireland, 1824, pp. 34, 41.

§ See Correspondence, p. 5.

|| The consequence of certified traced copies not being necessarily fac-similes of the paper original, is that, if required in judicial proceedings, the authenticity of the copies must be proved by witnesses in court. See Evidence of Mr. Leslie Foster, Report of Committee on Townland Survey, 1824, p. 37.

¶ On the importance of a copper original, both for the accuracy of the original itself, and the facility it affords for obtaining accurate copies at a low price, and making additions to the map by means of the Electro-type process, See Report of Col. Colby; Correspondence, p. 5; Capt. Yolland's Evidence before the Commission on Registration, Questions 1454 to 1457; 1639, 1644, 1737, 1975, and the remarks of Lieut.-Col. Hall and Captain Gosset, pp. 202, 215.

** See Col. Colby's Report, Correspondence, p. 6. Captain Yolland, Registration Report, Questions 1905, 1682, 1689, 1690.

weighty and numerous to justify and demand the construction of a public map on the scale above recommended; even though the measure sanctioned by the approval of Lord Langdale's Commission were abandoned.

Replies in favour
of the Decimal
Scales.

For instance, the townland survey of Ireland was undertaken for the purpose of equitably apportioning the grand jury cess, amounting, in 1824, to an annual charge of 750,000*l.*; and the survey has cost, to the present time, about 820,000*l.*; that is, more than one year's local taxation. The local taxation of England and Wales, according to the report of the Commission on Local Taxation, 1851, amounts to an annual sum of between eight and nine millions sterling; and the survey on the proposed scale, according to the highest estimate per acre, would cost considerably less than half a year's tax. There never was a case, I think, where capital could be more profitably expended.

II.—TOWN DISTRICTS.

The scale for Town districts should be an exact multiple of the scale adopted for Rural districts. Whether it should be in all cases the quintuple, may admit of doubt. In many villages and hamlets, a less multiple might perhaps be sufficient.

III.—POSSIBLE INCONVENIENCE OF DECIMAL NOTATION.

This question, I believe, concerns principally the land surveyor, who might use the map in computing acreage.

According to the scale of 4 parts in 10,000 of horizontal distance, the square inch will represent $\cdot 99,639,067$ of an acre; that is to say, one acre, less $\frac{3.6}{10,000}$ of an acre.

If the land surveyor neglects this small fraction, there will be as many acres, approximately, as there are square inches in the representation of the piece of land, on the map. If he takes account of the fraction, a mark must be put on the sliding rule, corresponding to the fraction $\cdot 99639$.

In the former case, the product of $\frac{\text{Base} \times \text{Perpendicular}}{2} \times 1$, in the latter case, the product of $\frac{\text{Base Perpendicular}}{2} \times \cdot 99639$, will be performed on the sliding rule with equal facility. There will, therefore, be no practical inconvenience in adopting the decimal scale of $\cdot 0004$.

In the case of the quintuple scale, the square inch on the map will represent, approximately, $\frac{4}{1000}$ of an acre, and correctly $\cdot 0398556$ of an acre; and, by putting a mark on the sliding rule, corresponding to the latter decimal fraction, the exact acreage may be correctly computed from the number of square inches on the map, with readiness and facility. The approximate value of $\frac{4}{1000}$ will also require a new mark to be made on the sliding rule. These several marks, any person acquainted with the principle of logometric instruments will be able to apply to existing sliding rules without difficulty.

The sliding rule, with the marks aforesaid, will give results expressed in terms of acres and decimal parts of an acre. These decimal parts cannot occasion any practical inconvenience to the land surveyor, since he is already in the habit of expressing areas in terms of the square chain and its decimal parts, the square chain being $\frac{1}{10}$ th of an acre.

Replies in favour
of other Scales.

REPLIES

IN

Favour of other Scales.

No. 1.

SIR WILLIAM CUBITT, F.R.S., CIVIL ENGINEER.

6, Great George Street, Westminster,
January 21, 1854.

I duly received your favour of the 16th inst. relative to scales for the Ordnance Survey, and on a careful consideration of the subject am of opinion,

1. That a scale of 20 inches to the mile, which is four chains to the inch, would be "sufficiently large to comprehend all the objects for which surveys "of rural districts" are usually made, and it has the advantage, which I deem it desirable that all surveys of rural districts for the use of the public should have, that the inches to the mile are convertible into chains to the inch without fractions, which is not the case with 24 inches to the mile, nor with any other number of inches which is not a multiple or sub-multiple of 80.

2. That for town districts 80 inches to the mile, which is one chain or 66 feet to the inch, would be sufficient for all the purposes of town surveys.

3. That the proportional lengths of the two scales above recommended being as one to four, the first being *stated* at 20 inches to the mile, and laid down on the plan with a scale of four chains to the inch, and the second (the town survey) being *stated* at 80 inches to the mile, and laid down with a scale of 66 feet to the inch. They are very easily converted into each other by either Land Surveyors or Builders; and the more easy things of this kind can be rendered to practical men, the more valuable they are.

4. In conclusion, I beg to state that the adoption of the decimal, or rather fractional scale alluded to in the last paragraph of the circular would be attended with this inconvenience, that all persons using maps so laid down would have a fresh lesson to learn without any useful object to gain, inasmuch as land surveying, mapping, and calculating quantities, are all upon the decimal system at present, and that of the most simple kind; and I have no doubt that, should the decimalising of weights and measures be successfully carried out in this country, the *standard* land surveying chain of 66 imperial feet would still have to be retained for all purposes of rural surveys.

No. 2.

MESSRS. R. J. AND H. CLUTTON, Land Agents.

Whitehall Place, January 23, 1854.

We have the honour to acknowledge the receipt of your communication bearing date the 16th instant.

The scales hitherto adopted in England for delineating estates or districts have all been referred to a standard of inches, and every one using maps has become accustomed to this system; we therefore adhere to our former suggestion for adopting a scale of four chains to an inch, or 20 inches to the mile. The complication of a three-chain scale, or $26\frac{2}{3}$ inches to a mile, will in practice be found considerable.

No. 3.

Replies in favour
of other Scales.

MR. RICHARD HALL, LAND AGENT AND SURVEYOR.

Cirencester, January 24, 1854.

I have the honour to acknowledge the receipt of your letter of the 16th instant, in which you request me to inform the Lords Commissioners of Her Majesty's Treasury which of the scales under-mentioned I would recommend, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made, viz.:

1. A scale of 24 inches to the mile for rural, and 10 feet to the mile for town districts.
2. A scale of three chains to the inch or $26\frac{2}{3}$ inches to the mile for rural and of 10 feet for town districts.
3. Scales bearing a definite numerical proportion to the linear measurement of the ground to be mapped, *i.e.* the scale of $\frac{1}{2500}$ for rural districts, and $\frac{1}{500}$ for towns.

To this I beg leave to reply, that while I believe each one to possess some peculiar advantage, yet regarding the subject in a national point of view, I could not unreservedly "recommend" either of them. They are all larger than would be required, except in extreme cases, for maps of rural districts, consequently their preparation would involve unnecessary expense, and they would be less convenient when prepared.

The set No. 1, being multiples of each other and also of the scale of six inches to the mile, to which a considerable portion of the country has been mapped would so far possess an advantage.

The set No. 2, not being multiples, are clearly for that reason objectionable. The scale of three chains to the inch is frequently found to be very useful, and has been much used in the preparation of estate and parochial plans: it is nevertheless not well adapted for general purposes.

The 3d set appear to be entitled to some consideration in these respects, viz.: that they are multiples of each other, but yet so that the town districts would have the advantage of an extended scale, viz., $10\frac{1}{2}$ feet to the mile instead of 10 feet only, as in the other two cases. That should a complete system of decimal notation in weights and measures be introduced, the maps could most readily be adapted thereto. That the scale is so large that the minutest accuracy in the computation of quantities therefrom might be attained. But on the other hand, it is evident that so long as linear admeasurements are denoted by "inches," "feet," "yards," "poles," "chains," "furlongs," and "miles," and these denominations retain their present relative proportions to each other, this disadvantage must arise, namely, an inch, a foot, a yard, &c., or the multiples thereof cannot be made to represent a mile, a chain, &c., consequently the scales which are now in use, and which are adapted to nearly all the maps at present in existence, would be quite useless when applied to such maps as these.

I would, in conclusion, beg leave to submit to you (while I am fully aware no one map can be made to subserve every purpose to which maps are applicable) that there is no scale so well adapted to general purposes in rural districts as the 20 inches to the mile, which in my former communication I ventured to recommend.

Maps constructed on this scale would possess the following advantages.

They would be less costly and would occupy less space.

Areas could be accurately computed from them.

The *inch* as well as the *mile* are preserved in this scale, 20 inches to the mile being also four chains to the inch; the latter bearing the decimal proportion to the former of .05 to 1.

This scale also (with very rare exceptions) bears an easily defined proportion to the scale of each and every map now in existence, including mineral surveys. It is moreover a multiple of the proposed town plan.

Replies in favour
of other Scales.

No. 4.

MR. JAMES DEERING, LAND SURVEYOR AND VALUER.

Midleton, Cork, January 27, 1854.

With reference to the contemplated scales for the Ordnance maps, I beg respectfully to state that, as a surveyor and valuator, I have for twenty years been in the constant use of the Ordnance maps of Ireland, and therefore may be pardoned for making a few practical remarks.

Of course it is with the engraved maps the public have to do, and whatever scale be adopted, it should as far as possible be suited to these, rather than to the manuscript maps.

In using the scale of the manuscript map on the engraved map, it is found (owing to the contraction of the paper, in the process of engraving) to be from 1-60 to 1-80 too long, more frequently the latter, hence the calculations from such scale are manifestly erroneous, and in making valuations of good land, involve great delay and inaccuracy. For the rural districts I greatly prefer the scale of three chains to an inch. I would have this scale ($26\frac{2}{3}$ inches to a mile) to suit the engraved map, and for the manuscript map a scale of 27 inches to a mile.

This I humbly submit would obviate most of the errors and inconveniences inseparable from the use of the same scale for both the manuscript and engraved maps.

Of course the scales for town maps can be graduated on the same principle.

No. 5.

MR. PETER BRUFF, CIVIL ENGINEER.

Eastern Union Railway Engineer's Office,
Handford Road, Ipswich, February 23, 1854.

In reply to your communication on this subject, I consider the Inch-scale is much to be preferred to the Six-inch, or any intermediate proportion, not only for general, but even for most local purposes, except where precise measurement is required, in which case actual survey will be resorted to, whatever scale the Ordnance maps are constructed upon.

Indeed, I conceive that there are few local improvements even, however limited their character, but what might be susceptible of benefit, from the general knowledge which the inch-map so readily affords, to an attentive observer, almost at a glance; where the six-inch map, from its voluminous and more expensive character, would oftentimes not be resorted to. Nevertheless, it would undoubtedly be useful, extremely useful, to publish detached portions of the country to an enlarged scale, similar to the practice prevalent in parliamentary surveys, in addition to the universal inch-scale; particularly such as tracts of mineral districts, where the topography frequently is rugged, complex, and difficult to show with sufficient detail to be intelligible upon the small scale. This leads to the suggestion, that in the event of its being determined to publish particular portions of a district on an enlarged scale, the same should be considered and treated as supplemental to the universal inch-maps, in which case, I would suggest, that *relative scales*, suited to the nature of the district, should be adopted, so that every part may be shown with greater clearness. In conclusion, allow me to draw your attention to the advantages which the public as well as professional men would derive, from greater attention being paid to the more correct delineation of declivities and undulated ground; for in my observations I have found, sometimes, almost in adjoining sheets, the relative ideas of the original delineators, or of the engravers or printers, I don't know which, to have been so totally different from the same character of ground, that I don't think I shall be exaggerating when I state, that declivities of, say 100 feet on one map, would be represented by the same intensity of etching as 10 feet on another map. This inconvenience has often, in my own case, given rise to considerable expenditure in profiling a district, which would have been avoided had more uniformity been secured in the execution of the maps.

No. 6.

SIR JOHN RENNIE, F.R.S., CIVIL ENGINEER.

Replies in favour
of other Scales.

Whitehall Place, February 24, 1854.

I beg to acknowledge the receipt of your letter of the 16th ult., relative to the proper scales for the Ordnance maps. In reply, I beg to say, that I consider the scale of six inches per mile is sufficient for all ordinary purposes. With regard to the scale for towns, I think that two feet per mile would be large enough for general use; and if maps upon a larger scale be required, let them be made at the expense of the parties requiring them; but I think that it should *be made imperative*, that copies of all maps should be deposited in a proper office for that purpose, and be rendered easily accessible to all.

No. 7.

MR. JAMES WALKER, F.R.S., CIVIL ENGINEER.

23, Great George Street, February 24, 1854.

I had the honour to receive your letter of the 28th April 1853, requesting me to state what scales I would recommend for any national surveys which may henceforward be carried on at the public expense. I am to assume that the results of the Ordnance Survey will, under any circumstance, be separately published on the reduced scale of one-inch to the mile, and the question upon which my opinion is desired is merely between the scale of six inches and any larger scale.

In replying to this request, I beg to refer you to my report of January 3, 1843, in answer to Mr. Pennington's instructions of December 20, 1842. In that report I strongly recommended the six inch as preferable to the one inch scale, and also stated that I considered the six inch preferable to a larger scale. As the above report may not be in your recollection, or at hand, I beg to enclose a copy of it herewith.

The eleven years that have elapsed since I gave this opinion, the perusal of the printed correspondence, evidence, and opinions with which you have favoured me, and the experience I have since had, have all tended to confirm my opinion. If the national surveys of the United Kingdom were to be begun now, and one mile to be adopted as the *unit*, it would be worth considering whether the decimal system would not be preferable, but I would not much alter the size from that of six inches; and now that Ireland and part of England have been published on the six inch scale, I should be decidedly averse to change it.

The general conclusion in my mind is, that for all public and national purposes the six inch is (for engraving and publishing) preferable to any much larger scale, even if the cost were equal, but that for private property and some details of parish purposes, the larger scale of $\frac{1}{2500}$ or $25\frac{1}{2}$ inches to one mile, which is nearly 18 times the size or area of the six inches, may be the better, and that it is as parties or individuals view it, in the public or in the private and local light, that their opinions are formed.

A solution of the differences and difficulties would be arrived at by taking the interests separately, letting the public have the engraving on a uniform scale of six inches per mile, and plotting the Survey to a large scale also, to be kept as a record, letting the parishes, if they apply for it, have a copy of their portion, the parties in this case paying for the expense of copying and paper, which would be comparatively small.

If such applications should not be general in England, this will be to be accounted for, partly at least, from each parish having already a large scale map showing its extent, boundaries, and divisions, made in pursuance of the Tithe Commutation Act of 1836, together with a book of reference, giving the areas, names of owners, and occupiers of each enclosure.

As an illustration of the great sizes of the maps, if made to the scale of $\frac{1}{2500}$ or $25\frac{1}{2}$ inches per mile, I would state:—

That the map of England alone would cover 31,300 square yards, or nearly $6\frac{1}{2}$ acres, and would take 46,950 sheets of paper of the same size as those of the Irish Survey.

Replies in favour
of other Scales.

That Scotland would cover 20,000 yards or about $4\frac{1}{8}$ acres, and would take 20,000 sheets.

That Ireland would cover 18,500 square yards, or $3\frac{3}{4}$ acres, and would take 27,750 sheets.

That Yorkshire, the largest English county, would cover 4,400 square yards, or about $\frac{7}{8}$ ths of an acre, and would take 6,600 sheets. And

That Rutland, the smallest English county, would cover 103 square yards, and would take 155 sheets.

Also, that if the sheets were to be sold at 2s. 6d.* per sheet, the cost to purchasers would be—

For the map of England	-	-	-	-	£5,868
„ Scotland	-	-	-	-	3,750
„ Ireland	-	-	-	-	3,468
„ Yorkshire	-	-	-	-	825
„ Rutland	-	-	-	-	19

While for, from $\frac{1}{12}$ to $\frac{1}{18}$ of each of these sums, what I consider a more useful map might be obtained.

A six-inch plate would probably cost more than a plate of the larger scale, but the greater number of the small scale likely to be sold would much more than compensate for this.

I apprehend, therefore, that few if any noblemen or gentlemen would think of purchasing more of such sheets than those containing their own estates, or those in which they might be locally interested, and if so, the maps would fail to answer the public purpose.

Also, that the cost of the copper for the large plates of England alone would, at 40lbs. per plate, and 2s. 6d. per lb., be 235,000*l.*, while for the six inch scale it would be only 13,000*l.*†

For Scotland, the copper for the large scale would cost 150,000*l.*, while for the six inch scale it would cost 8,100*l.*; and for Ireland the copper for the large scale would cost 138,700*l.*, while for the six inch scale it would cost 7,500*l.*

In my former report I showed by a diagram, that upon the six inch scale, the area of any enclosure, if not less than one acre, might (if to give areas be desirable) be distinctly given in figures, which would save others the trouble of taking the measurements and making the calculations from the plans, an operation with which all are not conversant; and as those areas would be taken from the field or chain measurements, they would be much more correct than it would be possible to calculate from a plan however large, particularly where the lines are curved or irregular. I have proved this practically, and feel confident that in all matters of purchase and sale, the parties concerned would not trust to any plan as being more than an approximation to the correct area. And although the difference of the bulk or size between $25\frac{1}{2}$ inch and the six inches would be in the proportion of 18 to 1, the difference in the measurement of length and distance would be only in the proportion of about four to one.

The case would be the same with engineering works, in which a distinct measurement would generally be required for taking the levels and laying down the sections, however large and correct, as regards the fences and boundaries, the map might be.

I do not suppose that in any public map, however large, it would be attempted to define the exact boundaries of estates or even parishes, so as to affect the interests of the owners, unless those on each side were previously to agree between themselves as to their boundary, which would be a difficult matter, and tedious if not impossible, in many cases, for the surveyor to bring about, and as a special power of settling disputed boundaries by consent is given under the Tithe Acts, any general attempt to define boundaries by a public map is less necessary and could not be generally done.

As to divisions of fields, I would remark that if it is considered expedient to show the fences or ditches which separate enclosures, both part of the same

* The average cost of the Irish sheets is above four shillings.

† These weights and prices are after inquiry.

estate, all fences (although the area enclosed by them be less than an acre) are shown distinctly upon the six inch map. Such a delineation to any larger scale would only give the fences and small divisions more minutely, as they were at the particular time when the survey of the particular farm was made, of which I don't see the public advantage, especially as these divisions are being constantly changed, hedges grubbed up to make two fields into one, and fences straightened. Indeed, improved modern agriculture frequently dispenses with all fixed fences, and substitutes hurdles, &c., so as to give the facility of changing the divisions as circumstances may at the particular time show to be likely to be most profitable in future cropping.

Replies in favour
of other Scales.

I have had frequent occasion to visit Ireland professionally, and I do not remember ever to have heard the Irish maps complained of as being too small, but, on the contrary, all I have heard has confirmed the opinion expressed by the Secretary of the Ordnance in a communication to you in 1840, viz., "that the map of Ireland is fully sufficient for every object for which a survey would be required," meaning, I presume, all public objects, although perhaps not for every private purpose nor for the details of engineering and such like purposes, for none of which would engraved maps, however large the scale might be, for the reasons I have stated, be alone sufficient.

Sir John Macneill (whose very great experience as an engineer of Irish railway and other public works, makes his opinion valuable), on the occasion of an accidental meeting, was good enough to give me his opinion, which was expressed very decidedly and strongly in favour of the sufficiency of the six inch scale, and he makes the same exceptions of private purposes connected with estates, for which alone he thinks the six inch scale might not be sufficient. I have since received from him the following letter:—

DEAR SIR,

Athenæum Club, February 22, 1854.

In answer to the query you put to me the other evening, as to the result of my practice in using the Ordnance Map of Ireland on the six inch scale, I have no hesitation whatever in stating that in my opinion the six-inch scale is sufficiently large for all practical purposes of the engineer, valuator, and agriculturist. I have used these maps in every variety of engineering, railways, canals, harbours, waterworks, and drainage, and I can with confidence assert that they are sufficiently large for every one of these purposes, and that they will afford the means of ascertaining the superficial contents of even small divisions of land with as much accuracy and certainty as can be had by the ordinary local surveyors of the county—in fact, I would sooner depend on them; and, latterly, since the level bench marks have been laid down on these maps, we can correct all our levels with the utmost certainty. I have never known the slightest error to occur in all my practice in Ireland, when I had an opportunity of testing these maps, and my practice has been very considerable in that country. I am quite sure, to alter the scale, or make it more than the six inches, would be a useless expenditure of money, and would not be so useful or practical as the six inches.

James Walker, Esq.

Yours faithfully,
(Signed) JOHN MACNEILL.

The following letter from Mr. Garrett, an engineer, now in England, and formerly county surveyor for Donegal, is confirmatory of the same opinion.

DEAR SIR,

Commercial Docks, Rotherhithe, February 16, 1854.

In reply to your inquiry relative to the scale of the Ordnance Survey, I beg to inform you that I consider the Irish scale of six inches per mile to be greatly preferable to one of two feet one inch per mile; which would, I think, be inconveniently large; indeed, the former appears to me to combine in nearly the highest degree the desiderata of smallness of compass and sufficient accuracy for the purposes to which such a survey is generally applied.

In deciding on the most desirable scale for a survey of this description, it should be borne in mind that it is not possible to select any one which will be the best under every variety of circumstances; the fitness of the scale varies with the closeness of the locality, and one which would appear large for an unenclosed mountainous district, might appear small when applied to the neighbourhood of a town or village.

Replies in favour
of other Scales.

My attention was particularly drawn to this, when as county surveyor for Donegal (an appointment which I held for three years) I was engaged in examining projected lines of public roads, through districts, varying from the open uninhabited mountain to those thickly populated portions where subdivision of property has been carried to a most injurious extent.

The duties of my situation comprised the laying out, carrying into execution, and maintaining of all public works of the county, and in connexion with these I was almost daily making use of the Ordnance Survey; I had also been in the habit of applying it (during several years previous to my taking charge of the county of Donegal) to the laying out lines of railway, improvement of estates by main drainage, &c., and as a check upon the general features of more detailed surveys.

The result of my experience of it is, that I do not think that any other scale would be more suitable than that of six inches per mile, for a survey of a similar nature.

I have not made so much use of the large scale plans of towns, &c.; but a scale of five feet per mile would, I consider, be sufficiently large for such a purpose.

I remain, very sincerely yours,
(Signed) ROBERT GARRET.

The following letter from Sir James Emerson Tennent, proves that the Irish six-inch scale is also useful, and considered sufficient for many private property purposes, although, as I have already said, I do not consider it, or any plan, sufficient where great accuracy is required:—

66, Warwick Square, Belgravia, London,

MY DEAR SIR,

February 24, 1854.

In reference to our conversation regarding the Ordnance Survey of Ireland, it occurs to me to mention to you a circumstance in illustration of the value and efficiency of the existing scale for practical purposes.

A few years ago it became desirable to divide an estate in the county of Sligo, which had been previously held by another gentleman and myself as tenants in common. In order to effect this, we were preparing to have a special survey and valuation, and as the lands lay in two remote baronies, the operation threatened to be rather costly. It was suggested to us to ascertain how far the Ordnance maps and the official valuation might suit our purpose and save expense, and we accordingly procured the necessary sheets. They proved to be amply sufficient, and the operation was satisfactorily completed by their sole assistance; thus enabling us to effect for a few shillings a partition, which, had we been compelled to resort to a special survey, would have cost a very considerable sum.

Mr. Davison, M.P. for Belfast, tells me that within his own knowledge numerous disputes between proprietors in the county of Antrim have within the last few years been satisfactorily settled by aid of the Ordnance maps, and these involved property of considerable amounts, dependent on the ascertainment of boundaries between town lands and parishes.

From my own observation, and the assurances of many friends of much more extended experience, I have no reason to doubt that for almost every conceivable ordinary purpose, the scale adopted in the Irish survey has proved to be eminently satisfactory.

James Walker, Esq.

Ever faithfully,
(Signed) J. EMERSON TENNENT.

Independently of the consideration of uniformity, (as a large portion of the United Kingdom is already surveyed, engraved and published,) and also the consideration of *price*, I believe that a great majority of those who have interests and business beyond those of private property would, if polled, prefer the six-inch scale to one of eighteen times the size.

I would even go further and say, that as respects local and private interests only, were I a landlord, having merely my own interests in view, I should still prefer the six-inch scale for the engraved general map, as it would enable me

to possess or refer to a map on a comparatively moderate size and price, which would not only show my own estate distinctly but also the county and country round it.

Replies in favour
of other Scales.

My conviction is, that the six-inch scale would practically answer all the useful purposes of the $25\frac{1}{2}$ inches, but that, for many purposes, the $25\frac{1}{2}$ inch would *not* answer nearly so well as the six inch scale. Indeed I think it very probable, as the one-inch scale is resolved to be engraved, whatever the larger scale may be, that the engravings on any larger than the *one-inch* scale may not for some time be required for portions at least of the moors and mountains of the Highlands of Scotland.

As to contouring or shadowing, of which a good deal is said in the papers I have read, my opinion is, that giving the levels in figures, which I think would be better and much less expensive than contouring, might be adopted for use in the six-inch map, and that the shading with a few of the principal levels or heights would be applicable to the smaller or inch maps. The contour lines confuse the map much more than the figured levels would do.

If it were not that many towns are, I presume, already engraved to the still largescales of five or ten feet per mile, I should be disposed to deal with *towns*, as I have recommended for *rural* districts, viz., letting the engraving at the public cost be confined to the six-inch scale, and the town authorities have an enlarged map at five or ten feet per mile upon paying for the cost. If at the public expense, small towns and villages, as well as cities and large towns, will claim to have the large scale map. My opinion besides is, that however correct the large scale maps may be, and perhaps useful as a record, as well as for giving general information as to the lines proper for the purposes of the Board of Health, any surveyor entrusted with the execution of works will not be satisfied without having the exact lengths and levels from his own survey.

Enclosure in No. 7.

MR. WALKER'S FIRST REPORT.

23, Great George Street, January 3, 1843.

I have had the honour to receive your letter of the 20th ultimo, which informs me that the Lords of the Treasury desire my opinion on the scale proper to be adopted for the Ordnance Maps of the Northern Counties of England, which have not been surveyed, and Scotland.

In reply to the first inquiry, as to the expediency of increasing the scale from one inch to six inches per mile, I beg to say that I consider this increase will afford great facilities and certainty to civil engineers in discovering the best lines for railroads, canals, and similar works, and therefore effecting a great saving to their employers. This arises not only from the larger scale admitting the minor divisions and greater detail to be shown, but also the *levels* to be marked at short distances, so that the map gives a general section of the ground as well as a plan, and enables the engineer to compare the levels of the country between his two termini in every direction without exploring or trial surveys and levels, which often form an expensive and tedious operation. When lately on a survey of the Dublin and Drogheda Railway, the only plans of the line which were put into my hands were sheets of the Ordnance Survey, and they appeared to be the plans which the engineers used for general purposes. Roads, rivers, and the other features of the country near the railway were shown with a correctness that was extremely useful. To have surveyed so great an extent for the purposes of that work only, would have been attended with *enormous* cost to the projectors, and therefore it would not have been done, so that the public and owners of property near to, though not *upon* the line, would not have possessed to the same extent the advantage they now do, of seeing how their property would be affected by or situated in respect of the railway.

AS TO EXPENSE.

I have understood Colonel Colby that on comparing the actual cost of the one inch with the six inches, the difference is not above fifty per cent., and

Replies in favour
of other Scales.

therefore I have no hesitation in saying that I think the advantages more than compensate this increase of expense.

The next inquiry is, if the six-inch scale be sufficiently large for all civil purposes. After the line for a road, canal, or railroad is determined on, a large scale-plan is required for measuring cubic and superficial quantities correctly, but no increase of the six-inch scale would, or at least should, supersede actual measurement in these cases, or in cases where evidence is to be given or purchases made; nor is the six-inch scale sufficiently large for showing towns; but a scale that would be large enough for showing the divisions of property in towns, would be preposterously large for a county, much more a kingdom. Assume, for example, an inch to three chains, (equal to nearly 27 inches per mile,) which has been named to me. Scotland, exclusive of its isles would, upon this scale, require 40,000 sheets, each nearly 30 inches square, which at 3s. per sheet,* would cost 6,000*l.*, and would cover an area of 250,000 superficial feet, or nearly six acres. Perthshire alone would require 3,000 sheets, which at the same rate would cost 450*l.*, and the area, nearly half an acre. What, therefore, is only large enough for towns, showing small divisions of property, would be inconveniently large for the country. The two must, I think, be taken separately. I recommended that for deposits in Parliament of proposed public works, the general plan of the line should be laid down at not less than four inches per mile, and that towns and buildings should besides be shown to a scale of not less than a quarter of an inch per 100 feet, or about 13 inches per mile. This has been in operation for a number of years, and I have never heard any complaint of it from landowners or engineers.

If, therefore, only one map is to be made at the public expense, I consider the six-inch scale to be sufficiently large, and likely to be on the whole more useful than a larger scale. The areas upon it will be larger than the Parliamentary plans for public works, in the proportion of nine to four, say more than double. As one acre to this scale will be very little less than a square of a

a. r. p. 1 - -	a. r. p. 1 - -	1 acre.
a. r. p. 2 - -	a. r. p. 2 - -	2 acres.
a. r. p. 3 - -	a. r. p. 3 - -	3 acres.
a. r. p. 4 - -	a. r. p. 4 - -	4 acres.
a. r. p. 6 - -	a. r. p. 6 0 0	6 acres.
a. r. p. 8 0 0	a. r. p. 8 0 0	8 acres.

Drawn to a scale of six inches per mile.

quarter of an inch, there will be space to give in figures upon the map, (*if thought desirable,*) the area of each enclosure of not less than an acre, which will be more correct than measuring from the largest scale. The figures in the margin show the sizes at six inches per mile of the areas, which are written opposite to, and also within them, and give a better idea of sizes than I could do in words.

It may be expected that some corporations, and the lords of some manors, and owners of estates, and others, who have not correct maps of their estates, may be desirous of taking advantage of the opportunity afforded by the Ordnance surveyors, for having maps of their property to a large scale, and may make application for this, offering to pay the additional expense, which could be previously estimated or approximated. I see no objection to a compliance with such applications, if made; on the contrary, the map might

be useful for public purposes, as for those of the Tithe Commissioners.

I have taken advantage of the great experience of Mr. Driver, Surveyor to the Commissioners of Crown lands, in the question respecting the Tithe Commissioners, and beg to inclose a copy of my letter to him, with his reply. It appears from the latter, that the use of the large scale map, is to ascertain the areas of fields or plots of land. Now I have stated that, where the quantity approaches an acre, the six-inch scale would admit the area to be given in

* The sheets of Ireland, which are a little larger than this, are five shillings.

figures, and that this would save trouble, and be more correct than measuring from *any* plan, however large; where, again, the quantity is a small portion of an acre, measurement upon a plan of 20 or 27 inches per mile could not be depended on.

Replies in favour
of other scales.

My opinion, therefore, in reference to the points referred to me by your letter, is in favour of the six-inch scale for the maps of the northern counties of England and Scotland.

I have, &c.
(Signed) J. WALKER.

No. 8.

LIEUTENANT-GENERAL SIR CHARLES PASLEY, K.C.B.

12, Norfolk Crescent, Hyde Park,
February 27, 1854.

In reply to your letter of the 16th ult., I beg leave to state that the scale of six inches to the statute mile, adopted for the Ordnance Survey of Ireland, appears to me to have been a very great improvement upon the one inch scale, previously used for the trigonometrical survey of Wales, and part of England, under the same department.

This scale, which is very satisfactory for many purposes, having also been adopted for several counties of England and Scotland, I consider it essential that, when a larger scale is necessary in any rural district, some integral multiple of the same shall be selected.

I therefore beg leave to recommend that a scale of 12 inches to the mile shall be adopted for rural districts, in which plans on a smaller scale would be insufficient for public records of property.

But in districts in which, from the higher value, or minuter sub-divisions of property, a still larger scale might be deemed necessary, I recommend 24 inches to the mile.

Whichever of the above scales may be considered necessary as public records, for the valuation of property in any county or district, let plans on these scales be engraved at once for general sale, and the copper plates preserved, instead of making draft plans on a larger scale, which appears to me to be a useless expense.

I entirely disapprove of plans of three chains to the inch for rural districts, because this, being equivalent to a scale of $26\frac{2}{3}$ inches to the mile, is not an integral multiple of the scale of the Ordnance Survey, and for the same reason I disapprove of scales of any other number of chains to the inch, whether greater or less than the above.

In respect to towns, I beg leave to recommend a scale of five feet, or sixty inches to the mile, for engraved plans for general sale, like the Ordnance map of Liverpool, in which the thickness of the walls on the ground plan of churches and public buildings, the frontage and depth of every dwelling house, and even the steps before all the street doors, are distinctly represented.

To require plans of double this scale for record, as has been proposed, in imitation of the system of some of the continental governments, appears therefore to me to be not only useless, but a perfect absurdity.

Regular lines of contouring, intersecting the houses, cannot be laid down in a plan of this description without confusion, and therefore a sufficient number of altitudes, referring to the same datum level, must be inserted along the streets, like soundings in a naval chart, at points marked in the plan and carefully preserved, which will enable the engineers or surveyors employed by the municipal authorities of a great city, to lay out properly the principal sewers and the drains leading into them.

Having stated my opinion that four scales, namely, those of 6, 12, 24 and 60 inches to the mile, are the only scales necessary for rural or for town districts, and that no others should be used, I entirely object to the scales recommended by the Statistical Society of London and the Statistical Conference at Brussels, for unless all governments should agree to adopt the same standard of linear measure, (for which, in a treatise on measures, weights and money, published by me 20 years ago, I recommended the fathom of 1,000 to the geographical or nautical mile, this mile being the only universal measure

Replies in favour
of other Scales.

acknowledged and used by all civilized nations, which even the revolutionary government of France has been unable to set aside,) the proposed scales of $\frac{1}{2500}$ for rural districts, and of $\frac{1}{500}$ for towns, bear no definite numerical proportion on the ground to be mapped, if measured by any other standard except the French metre; for though they also imply the very same proportions of $\frac{1}{2500}$ th or of $\frac{1}{500}$ th parts of an English statute mile, yet when reduced to feet or inches they become very inconvenient fractional numbers; and in like manner any of the scales of the Ordnance maps, such as those of 24 inches and of five feet to the mile, which bear the no less definite proportions of $\frac{1}{2640}$ and of $\frac{1}{528}$ respectively, when applied to the French metre, or to any other standard measure of the continental nations, become very awkward fractional numbers.

Should any proprietor wish to have a plan of his estates, whether in a rural district or in a town, drawn on a larger scale than any of those four that have been enumerated, let him apply to the officer superintending the Ordnance Survey for the time being, on the part of Government, who has the means of surveying it, at the proprietor's expense, more economically and with much greater accuracy than any private surveyor could do; for by the excellent system laid down by the late General Colby, the field books of every man of the Royal Sappers and Miners, as well as the trigonometrical observations of the officers of Engineers, under whom they were employed, are carefully preserved, so that if an error were detected one hundred years hence, not caused by pulling down houses or constructing new works, it could be traced to the individual who was responsible for it; and as the non-commissioned officers and privates employed have been paid in classes, according to their qualifications, their work is acknowledged to be more accurate than that of former surveyors under Government, who were paid by the square mile, and that of all surveyors paid by contract, such as those acting under the Tithe Commissioners.

Of Shading.

Shading is well suited to maps of one inch to a mile, like the original Ordnance maps of England and Wales, and would be still more appropriate to maps on smaller scales, such as a half or one-third of an inch to the mile, like those of the index or county maps of the Survey of Ireland, provided that such maps are not confused by crowding into them too many names of insignificant villages; and whatever engineer officers, assisted by draughtsmen and engravers on the *present* establishment of the Ordnance Survey Department under Lieut.-Colonel Hall, may be employed in this task, for which there are many competent, I feel confident that their engraved maps of Ireland and Scotland, and of the remaining counties of England, on the one inch scale, with the hills shaded, will not fall short, in point of execution, of the first Ordnance maps of England and Wales, surveyed and engraved at so much the square mile nearly half a century ago, and will as much exceed them in accuracy as they did the former county maps of that day published by private surveyors.

Of Shading as compared with Contouring.

However barren and unfit for cultivation any considerable tract of country may be, I do not think that maps of less than six inches to a mile should be made in the Ordnance Survey of any part of the British Islands, because it is important that the features of the ground, which in such desolate tracts are usually the most striking, shall be correctly explained, which can only be done by contours or lines of equal altitude, rising in steps of 25 feet above the mean level of the tides from some given point on the coast, as a datum level, independent of shading—a system inapplicable to maps on a small scale.

For example, in sheet 13 of the map of Kirkcudbrightshire, on the six inch scale, representing a wild and thinly peopled tract of moors and mountains, with burns welling out from their summits or sides, and swelling into little meandering rivers in the deep valleys or glens between them, the contours afford the only satisfactory, because the only strictly accurate delineation of the nature of the country, for though a beautifully shaded drawing might be made by an artist in possession of the plan alone, it would not be of the smallest use to an engineer in laying out roads, railways, canals or works of drainage or irrigation; whereas the contours without shading, according to the system

adopted in all the Ordnance maps on this scale, would enable him to plan such works in his closet, after an inspection of the ground; for by means of one sheet of such a map, covering a space of 24 square miles (rather more than 15,000 acres), which may be purchased for a few shillings, he could draw numberless sections all perfectly correct, in any direction he might think proper, within its limits, with a saving of many hundreds of pounds to the public company or individual by whom he is employed, as well as of time, for without the aid of such contoured maps he would be obliged to survey and take sections of the ground himself, or have it done by surveyors hired for the purpose at the expense of his employers.

Replies in favour
of other Scales.

To conclude this comparison, I may remark, that the contours on the six inch scale of the county maps will afford the officer who superintends the hill shading of the proposed maps of one inch to the mile, data for sketching them in a manner much more conformable to the physical character of the country, than can possibly be accomplished by an artist of equal skill not having this advantage, whose sketches on the ground must in a great measure be done at random.

No. 9.

COLONEL OLIVER, H.E.I.C.S.

43, Duke Street, Grosvenor Square, March 1, 1854.

I have the honour to acknowledge the receipt of your letter of the 27th ult. calling on me to say which of three proposed scales for rural and town district maps, I would recommend.

In reply, I beg to state that being of opinion that large scales, except for very limited surfaces, are in general inconvenient, I should of the three proposed prefer the first, as being in some degree the smallest.

Although not required by you to do so, perhaps I may be permitted to state as my opinion, that I conceive a much smaller scale (six, or at most eight inches to the mile) for rural districts, would be sufficiently large for all generally useful purposes; of course in some particular cases a larger scale might be necessary. As to maps of towns and cities, having had no practical experience in the construction of such maps, I do not feel that I should be justified in offering an opinion.

No. 10.

MR. J. B. McCLEAN, CIVIL ENGINEER.

17, Great George Street, Westminster, March 2, 1854.

I should recommend the scale of 24 inches to a mile for rural districts, and of 10 feet for towns, in preference to the second and third proposals, supposing it to be determined that the scale shall be sufficiently large to comprehend all the objects for which surveys and plans are usually made. At the same time I am of opinion that a scale of five chains to an inch, or 16 inches to the mile would be more convenient for all purposes. It is a scale sufficiently large for the general plan of engineering works, and to show the sub-divisions of lands; it is one from which the contents of enclosures and the lengths of roads, and of drainage works may be calculated with facility by any one possessing a foot rule, which is the common measure of the country, and to be found in places where neither compasses nor scales have ever reached.

The varying scale stated in No. 3 proposal is most objectionable, as any one who uses the key maps of the counties in Ireland, which are all on different scales, must know.

No. 11.

SIR DENHAM NORREYS, BART.

Athenæum, March 3, 1854.

I object to all your scales, because I consider them too large for any useful purpose, other than that of giving, at the public expense, to every proprietor

Replies in favour
of other Scales.

in Scotland a map of his cabbage garden. I prefer No. 2 to No. 1, not because it is larger, but because it depends on a definite and intelligible portion of the inch as a basis; as I consider it of much greater importance in maps of this kind to be able to measure on them *to the perch* (one fourth of a chain), with an ordinary division of the inch (in this case one third of an inch to a chain, or one twelfth of an inch to the perch), than to have a certain number of inches to the mile; but recollect, that both could have been combined without much deviation from size; e. g., 20 inches per mile would have given four chains, or 16 perches to one inch. Every common rule is divided into eighths of an inch (*i.e.*, two perches to one eighth of an inch). Every eye can very closely measure the half of one eighth of an inch, *i.e.*, the perch. Thus, by an ordinary rule you could measure from the mile to the perch. Compare the greater facility of measuring on a map laid down to 20 inches per mile to one on "26 $\frac{2}{3}$ " (No. 2). I fairly confess I cannot comprehend the reasons which have led to your Treasury determinations on this subject.

APPOINTMENT OF A COMMITTEE ON THE SCALE OF THE ORDNANCE SURVEY,

AND

THE RESULT.

No. 1.

TREASURY MINUTE, *dated June 13, 1854.*

Transmit to Sir John Burgoyne, Mr Blamire, and Mr Rendel, the Replies which have been received to the Circular Letter from the Treasury, dated the 16th January last, and state that My Lords have been pleased to appoint them to be a Committee for the purpose of considering the Evidence which these Documents contain, and reporting what in their opinion is the conclusion to be derived from it, in reference to the question between the Scales of 24 inches to the Mile, $26\frac{2}{3}$ inches to the Mile, and $\frac{1}{2500}$ of the linear measurement of the Ground to be mapped, which have severally been proposed for laying down the results of the Ordnance Survey of Rural Districts.

Appointment of
a Committee and
the Result.

No. 2.

REPORT OF THE COMMITTEE ON SCALES.

SIR,

Ordnance Office, July 6, 1854.

We have the honour to inform you that, as the Committee appointed by authority of the Lords of the Treasury, by letter dated 14th June, "for the purpose of considering the Evidence which the accompanying documents contain, and reporting the conclusion which in our opinion is to be derived from it, in reference to the question between the Scales of 24 inches to the Mile, $26\frac{2}{3}$ inches to the Mile, and $\frac{1}{2500}$ of the linear measurement of the Ground to be mapped, which have severally been proposed for laying down the results of the Ordnance Survey of Rural Districts," and having weighed and analysed the evidence laid before us, and confining ourselves to the specific question referred to us, we have come to the conclusion, and beg to report as our opinion, that—

The weight of evidence contained in the printed Correspondence submitted to us, is decidedly in favour of the scale of $\frac{1}{2500}$ of the Linear Measure of the Ground to be mapped.

Whilst thus reporting to you the conclusion that we have arrived at on the subject directly referred to us, we would beg to be permitted to recommend that, in adopting for the Plans of the National Survey, any scale so large as to be available for Property purposes and the determination of the acreable contents, or Areas, for the sale and transfer of Land, public attention should specially be pointed to a fact which does not appear to be brought out with sufficient clearness, in the printed Correspondence, for unprofessional readers, viz :

That the Plans must of necessity represent the surface of the Country as it would appear projected upon a horizontal plane; and that the Areas obtained by admeasurement from the plans so projected, must, in mountainous and hilly districts, be less than the actual superficial admeasurement of the ground.

A means of estimating approximately the difference will, however, be afforded by the Surface Levels, or figures indicating the actual altitude above the Sea, of numerous points upon the map, along the hills and the valley lines; and Tables may readily be calculated to show the per-centage allowance to be added, in every case, to the horizontal admeasurement of the land, for every

Appointment of
a Committee and
the Result.

degree of inclination of its surface, or for inclinations of any given number of feet in 100 feet of horizontal distance.

We have, &c.

(Signed) J. F. BURGOYNE.
WM. BLAMIRE.
JAS. M. RENDEL.

Sir Charles Trevelyan, K.C.B.
&c. &c. &c.

No. 3.

TREASURY MINUTE, dated July 15, 1854.

My Lords read again their Minute, dated April 15, 1853, by which it was directed that, pending the final decision as to the Scale upon which the Ordnance Survey should for the future be conducted, the Fieldwork of the Survey of Ayrshire and Dumfriesshire should be carried on with that degree of accuracy which would admit of the Plans of the Cultivated Districts being hereafter drawn to the scale of 24 inches to a mile, if desired.

My Lords also have before them the Report of Sir John Burgoyne, Mr. Blamire, and Mr. Rendel, the Committee appointed by their Lordships' Minute, dated June 13, 1854, for the purpose of considering the Evidence which the Replies to the Circular Letter from the Treasury, dated 16th January last contain, and reporting what, in their opinion, is the conclusion to be derived from it, in reference to the Question between the scales of 24 inches to the mile, $26\frac{2}{3}$ inches to the mile, and $\frac{1}{2500}$ of the linear measurement of the ground to be mapped, which have severally been proposed for laying down the results of the Ordnance Survey of Rural Districts.

This Committee has reported unanimously their opinion, that the weight of Evidence contained in the printed Correspondence submitted to them, is decidedly in favour of the scale of $\frac{1}{2500}$ of the linear measure of the ground to be mapped.

Under these circumstances, My Lords are of opinion that the Surveys of Ayrshire and Dumfriesshire should be laid down and drawn on paper to the Scale recommended by the Committee, *i.e.* $\frac{1}{2500}$ of the linear measurement of the Ground; and that upon the margin of every separate Sheet of the Map, in addition to the Statement of the proportion which the linear measurement of the Map bears to reality, there should be drawn Scales, expressing English Feet, Yards, Chains and Miles, so as to provide for a ready comparison with other Maps.

My Lords are also of opinion that, until a final determination shall be arrived at, as to the Scale upon which the Ordnance Survey shall be conducted and engraved, the course which has been authorized in reference to Ayrshire and Dumfriesshire should be applied to the Survey of other Districts.

Previously, however, to sanctioning the adoption of the large Scale as a general measure, My Lords deem it right to ascertain by actual experiment the increased cost of such Surveys and Maps, in comparison with those drawn to the Scale of Six inches to a Mile; and they therefore desire that in the further progress of the Survey of Rural Districts, trial be made of the system of Piece-work within the Department, and of that of independent Contracts with other Surveyors supervised and approved by the Officers of the Survey; and that an accurate Account be kept under separate heads of the Cost of the Work according to each of these Processes, as well as according to that of Daily pay, hitherto in practice; and that a Report be made to this Board at the earliest practicable date, of the Expense of the Survey on the large scale, according to each of the above processes, as compared with that of the Six-inch Scale.

Transmit a copy of this Minute to the Secretary to the Ordnance, for the information of the Board.

CORRESPONDENCE

ON

CONTOURING AND HILL DELINEATION.

No. 1.

Sir CHARLES TREVELYAN to Major LARCOM, R.E.

Contouring
and
Hill Delineation.

October 20, 1853.

You saw what important questions are at issue in reference to the Ordnance maps, and we should be glad if you would give us further assistance on the especial point of *Contouring*, of which you are the father in this country. Will you kindly state in writing your reasons for thinking that the map ought to be contoured, and explain the extent to which it should be applied to different descriptions of land, the sites of towns, highly cultivated country, wild and mountainous districts, and so forth.

No. 2.

Major LARCOM to Sir CHARLES TREVELYAN, K.C.B.

Dublin, 7th November 1853.

You ask me to state why I think the map ought to be contoured, and explain the extent to which contouring should be applied in different descriptions of land, the sites of towns, highly cultivated country, wild and mountainous country, &c.

1st. I think maps ought to be contoured, because it is important the height of the ground should be shown, and I know no way of showing it so good as by contours or lines of equal altitude. I suppose it is not necessary to discuss the importance of some mode, and we have, therefore, only to consider the different ways in which it has been, or is, proposed to be done. Take for example the Ordnance Survey itself. At first, in England, the altitudes of mountains and of prominent objects were calculated from vertical angles observed with the same instruments, and at the same time with the angles of azimuth for triangulation, and those altitudes were published in lists with the lengths of the sides. Subsequently they were engraved on the maps themselves, and as the maps were on a small scale, the form of the ground and its general features were inserted in the manner which at that time was usual on military plans, by the military draftsmen who were employed. These maps were a model of perfection in their day; nothing had been produced like them in any country, and Captain Mudge was made a Brevet Major, at the recommendation of the Duke of Richmond, when the map of Devonshire was published. This mode of inserting the details of the ground by the eye, aided by the trigonometrical altitudes, was continued and improved by the draftsmen employed, and was ultimately carried to perfection by Mr. Dawson, who united the taste and

ability of an artist, with an eye of singular correctness, and long experience. Nothing can exceed the beauty of some of the drawings of North Wales. I well remember the admiration with which Chantrey examined and studied them when he was consulted by Colonel Colby on the subject; but it is necessary to have known Mr. Dawson, and to have accompanied him in his mountain labours, as it was my good fortune to have done while enjoying the advantage and privilege of his instruction, to appreciate the enthusiasm with which he cultivated his favourite pursuit, combining it with geological and botanical researches, and connecting all with the form and elevation of the ground. And beautiful as the drawings are, it is only those who know the ground itself, its rugged and varied character, who can feel the truth and correctness with which his drawings convey that character to the eye.

All this had been accomplished when the survey of Ireland began; but that survey was not limited to the requirements of a general map. It was to be a territorial survey. It was to give contents in acres, as the basis of an amendment in local taxation, which required a new and careful valuation of every farm and holding in the country. It was no longer sufficient merely to delineate the general form of the ground; the height, the slope, the aspect, and exposure, were important elements in valuing land; and Colonel Colby devised a mode of furnishing this information to a great extent without materially increasing the expense. The heights of all the principal and minor trigonometrical points were obtained as in England, in connexion with the triangulation; and as the sides of the minor triangles had all to be chained, to ascertain the points at which they crossed the boundaries of townlands, and to form the bases for the yet smaller triangulation which descended from them for obtaining the townland areas, it was only necessary, in reducing those chained lines to their horizontal length, to calculate the perpendicular in addition to the base (the sine and cosine), when by addition and subtraction from the trigonometrical altitude of the starting points, the height was at once obtained of every point at which the theodolite was set up. Thus, without any separate process, sections of the ground were furnished on every such line from point to point over the whole country. This is the history of the lines of figures which appear on the Ordnance 6-inch sheets, radiating from station to station. Each figure was in itself an abstract fact, expressing the height of the ground at that point, and each line of such figures furnished a section of the country it passed over.

But while the survey was in progress the engraving and publication of the early counties, and consequent general diffusion of the maps, led to their application to other purposes. Ireland at that time was advancing. Improvements of all kinds, roads, agriculture, and reclamations, were found to derive increased facilities from the correctness and cheapness of the new maps. But connexion between the insulated figures of altitude was wanted. More than all, railways at that time began. With a view of generalizing the numerous projects the Railway Commission was established. The Commissioners, taking a general view of the requirements of the country, and regarding the island as a whole, looked first at its general features, its vallies and mountain ranges, in order to unite the several towns and districts by communications which should accommodate the greatest extent of country with the least extent of line. Hence general altitudes became essential. It was all important to cross the ridges at their critical points, and circle round their sides without sacrificing level.

These new applications of the maps all pointed to horizontal level lines, and it was a very easy step to endeavour to connect the section lines with each other, by uniting the points of equal altitude on them. These would be contour lines, and would not only fill up a picture of the ground, but by dividing the country into zones or belts, would furnish the required information, both absolute and comparative. But it would assume that the form of the ground between any two of the radiating lines was of the same form as one of them, or passed from one section to the other by a regular figure, which of course was not the case; on the contrary, it would frequently happen that an important gorge or obligatory point lay between them, and was therefore undetermined; so that, although the ingenious mode adopted by Colonel Colby for levelling the sides

of the triangles answered to a great extent the purpose intended, by furnishing numerous points of altitude, and was a great advance on what had been done before, it was insufficient to give the form of the ground or portray the undulations of the country, with a correctness corresponding to the perfection which the other branches of the map had attained, and it became a question whether it would not be better at once to adopt the continental system of contouring. But half the country was completed. The men were trained and at work, and it was no time for change. The subject, however, was fully discussed. Colonel Colby entirely concurred. It was brought, in 1843, before the British Association at Cork, and recommended by that body. In the same year it was made the subject of inquiry by a committee appointed by Sir R. Peel, and adopted. (Parl. Paper 527, sess. 1844.) An effort was then made, by taking up a county in advance (the county of Kilkenny) to introduce it on the original 6-inch maps; but the great machine moved too rapidly, and its adoption as the original mode of levelling was deferred for the survey of Great Britain, and carried on from that time in Ireland only in connexion with the revision of the 6-inch sheets, and the preparation of the general map, for which it was foreseen it would form a valuable basis. We have now, therefore, in Ireland, the original arbitrary lines of levelling, or section lines, and the contours in addition; and I think it probable that it may frequently be found advantageous to run lines of altitudes along the ridges of hills and down their spurs, in addition to the contours, in England, as proposed some years ago, by my friend Colonel Dawson, in his able paper on the Tithe Surveys.* This may depend on the judgment of the surveying officer.

It is to be observed that contouring has this advantage over the former mode, viz., that it is deduced from bench marks, which are fixed by spirit levelling; while the former depended on altitudes obtained trigonometrically, which is a less rigorous process. The one deduces the high ground from the low, the other the low ground from the high, so that by contouring, the lower levels, which are the most important, are also the most correct.

I do not think you expect me to discuss all the opinions on this subject contained in the volume you gave me. The preponderating evidence appears to me decidedly in favour of contouring; but I have carefully read all that is urged against it, and I must say there is nothing to shake my own opinion that to discontinue contouring would be to give up the experience of the most extensive survey yet made in these islands, as well as the conclusions arrived at on the continent.

2d. As to the extent to which it should be carried in different places, and different descriptions of ground. This must depend so much on the judgment of the Surveying Department, guided by the object to be attained, or the purpose to which the plan is to be applied, that it is very difficult to give any general opinion; and I would not recommend the Treasury to lay down any precise instructions on that point.

It is probably desirable that certain normal lines should everywhere be run, such as 100 feet lines, up to 500, or even 1000 feet, and that above that elevation they should be less frequent. Between these, 25 feet lines may be advantageously interpolated for the first 500, then 50 feet lines to 1000. Special contours, either continuous or for short distances, may occasionally be necessary for particular forms of ground. I think it is well to keep certain lines constant, as is done in Ireland, but not to dictate too closely in detail. In addition to this there will, I presume, be numerous bench marks on the prominent buildings and durable objects, not only marked on the maps, but published in lists, as is in progress also in Ireland; so that every one may possess the means of running special levels from a correct datum, for any local purpose. This I think quite sufficient for a 6-inch map, with which I am most conversant; and if the larger scale of 12 or 26 $\frac{3}{4}$ inches be adopted for Great Britain, or any parts of it, I hardly think a greater number of normal contours necessary, but additional interpolations may be desirable.

* September 8, 1836.—See Parliamentary Papers, "Survey of Lands (Tithe Act)."

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Where the scale is very large, the space of country under the eye at once, becomes so much less, that there would sometimes be considerable tracts without a contour line, and dependent only on the bench marks. Some people would not regret this; but I confess, for my own part, I should like every plan presented to me, on the largest scale, even of a single field, to have a line of equal altitude run across it. It is a sort of axis. It locates it in altitude as a meridian or parallel does a geographical map in space.

I do not know that any particular rule applies to towns. Much there, also, must depend on the scale, and more on the purpose for which the plan is made.

I do not think any system of contours, or any general system of expressing the third ordinate (as the French call the altitude), can be expected to dispense with local levelling for specific objects, and less and less so as the scale enlarges.

There are many other points connected with this subject,—as the Datum, whether mean tide or an arbitrary plane many feet lower, above which the contours should be given; and many details as to the mode of representing the contours, as in a different colour, or pressed into relief, and several others, on which experiments were successfully tried at the Irish Survey Office at Mountjoy before I left it—whether the contours, normal and interpolated, may not with advantage be shown on the sheet lines, like degrees and minutes—how the direction of the fall from a contour line can best be shown—and many such. But I think all the Treasury need do is to affirm or approve the principle; all else may best be left to the Surveying Department, giving it every encouragement to improve, and urging it to keep in advance, applying the results of science and knowledge as they arise to the increasing perfection of the important duty entrusted to them.

Thus far I have adverted chiefly to large scale maps, on which the altitudes are required for purposes of practical or mechanical detail; and I think contours and bench marks furnish all the requirements of these subjects better than any other mode with which I am acquainted.

3d. I think also the contours afford an authentic surveyed basis for the more general representation of ground on the 1-inch map; but while I think them valuable as affording to hill drawing the support of scientific accuracy, it would appear a backward movement to discard the aid which art can give. Whether the contours may or may not be shown with advantage on the engraved 1-inch map, or given on a separate outline plate, is a question of detail, which may be safely left to those who are charged with the engraving, and are responsible for its perfection and utility, but I would not recommend that they should stand alone, or be considered as dispensing with an artistic delineation of the features, to be performed by draughtsmen on the ground itself. Contours raise hill drawing to a higher standard of accuracy, in the same proportion that the outline also is raised in perfection in the modern and larger maps, but they only improve, they do not supersede it. I entirely feel the desirability, in point of economy, of reducing hill drawing to mere mechanism, which the representation of ground by contours alone would completely effect, but I think it would produce but an imperfect representation of the country, and the public have a right to expect that the national map shall be a triumph of art as well as of science.

No. 3.

LIEUT. COLONEL DAWSON to Sir C. TREVELYAN.

7, Whitehall Gardens, December 15, 1853.

THE advocates of Contouring rest its claims to consideration on the ground of its alleged accuracy—that it is “perfectly accurate” (*a*)—“the only known mode of representing ground on paper so that a perfectly accurate general section could be made from the plan of any arbitrary line” (*b*)—that it “models the ground with accuracy,” (*c*)—“affording the rigid accuracy the engineer desires,” (*d*)—and “conveys all the information of a model without its inconveniences for practical purposes;” (*e*)—“would enable any person to make a correct and accurate model of the whole country,” (*f*)—and, as applied to the representation of ground in plan, that—“contours are the only true and perfectly correct method of representing the conformation of the surface of a country,” (*g*)—that contours “must *be correct*,” (*h*)—that hill delineation by simple contours “is, literally and strikingly, a correct representation of the physical relief.” (*o*)

Admitting the principle which forms the basis of the system to be theoretically and mathematically true, I apprehend that, in its application to the objects of a national survey, what should properly be desired is, not that which is theoretically and mathematically feasible, but what would be found practically useful, and justifiable in point of expense. It will be found, however, that this perfection of accuracy is attainable only when the principle is carried out in its integrity to the fullest possible extent, and that the cost of the operation would then be perfectly unjustifiable. The most strenuous advocates of the system do not advise this, but recommend the adoption of it only in a modified form, with intervals varying at different stages of elevation.

It will be desirable to ascertain, therefore, what claim to accuracy Contouring has in this modified form, and what is its cost; what practical benefits are to result from it; and whether practical benefits of a similar nature, and to an equal or sufficient extent, might not be obtained under a different system of procedure at a considerably less cost.

Starting with the mathematical principle which requires the contours to be drawn at equal vertical distances apart, a cone would be represented by a regular series of concentric circles, a pyramid by a series of triangles or squares, and a prism, or roof, by a series of parallelograms. These lines may be said to represent mathematically the forms to which they apply; but they cannot be substituted for hill-shading on artistic principles, because the simple contours on regularly inclined surfaces, or hachures drawn uniformly at right angles to those contours, would to the eye, at a little distance, express only a flat shade, and the forms would be better represented, and more intelligibly to ordinary observers, by the principles and practice of art.

It may be said, however, that this is an extreme view of the question, and this is a selection of forms which never occur absolutely in nature; that the forms of nature are rounded and undulating, and varied in a manner which gives effect to the contours, and makes them more expressive; and such in reality is the case. But if the claim of Contouring to consideration is to be based on its mathematical accuracy, and on its affording literally and strikingly a correct representation of physical relief, it should surely be applicable to the expression of the mathematical forms which are the bases of the natural forms of ground, as the cone, the pyramid, and the prism really are.

The wedge and hemisphere are other mathematical forms applicable to ground; and in the expression of these forms contours are more effective, because of their varying intervals.

Let us now consider the proposed modified System of contours in its application to these forms, as a test of the accuracy of the system, and it will be seen that the immediate effect of increasing the intervals between the

(*a*) Survey (Scotland) Committee, Q. 1553.(*c*) Map of Ireland Committee, 1853, page 2.(*h*) Correspondence, page 223.(*b*) Correspondence, page 218.(*d*) Ibid.(*e*) Correspondence, page 218.(*f*) Survey (Scotland) Committee, Q. 1507.(*g*) Correspondence, page 222.(*o*) Survey (Scotland) Committee, Q. 1788-9.

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contours, at different stages of elevation, as recommended by its advocates, must be to vary the apparent rate of inclination of the slope, and, as in the hemisphere, to give an appearance of roundness to surfaces of uniform inclination; to make the cone, in fact, appear like a hemisphere, and to give to all right lined angular figures a rounded form.

Contours, therefore, to be truthful, must be separated from each other by a fixed interval in vertical measurement; and that interval must be constant throughout, from the lowest to the highest level. It will not do to increase the interval at different stages of elevation, for that would produce an erroneous expression of the forms and slopes; and if the hill-delineation is to be produced by the contours alone, the interval in vertical measurement must be very small, as the increase of the interval would tend to the omission of more and more important features and details.

Thus, for instance, supposing the contours to be 500 feet apart in vertical measurement, as has been suggested for mountain ground, it would be possible that an abrupt slope of nearly 1,000 feet might pass altogether without notice in the map. In like manner, if the contours are only 25 feet apart, as at present in the lower grounds, steps and breaks of nearly 50 feet may escape notice; and this embraces an extensive class of features, interesting to the geologist, and important to the practical engineer.

It would certainly be possible to make a model by means of instrumental contours; but the model would then represent only an assemblage of rounded lumpy forms, like the lay-figure of the artist, without any distinctive character; and the attempt to obtain characteristic expression (were it even practicable), by contouring alone, would require the contours to be so close that the expense of the operation would be perfectly ruinous.

A further practical objection to Contouring, in its most perfect form, arises from the fact of the contours being not real but imaginary lines, with no visible position upon the ground. Their place can in fact only be discovered on the ground by measurements from the angles of fences, and other established points. In towns and other districts thickly covered with houses, and in precipitous, wooded and rocky districts, it must be utterly impossible to trace continuous contour lines upon the ground.

A perfect System of Contouring must therefore be considered impracticable, and the modified system will give only approximate and not strictly accurate results.

From the want of personal experience I cannot attempt to say what Contouring should properly cost. It has been estimated by the Ordnance at 4*l.* per square mile for the whole of Scotland on the 6-inch scale, and I cannot doubt that on a still larger scale the cost would be very considerably increased. The fact is, that unless it be well done it must be practically useless, and if well done the cost must be very great. A district of 14 square miles in an average sheet (Sheet 147, Yorkshire), includes by admeasurement 64 linear miles of instrumental, and 454 linear miles of interpolated contours.

It is admitted that Contouring, to the extent which it has been proposed to carry it, will not supersede the necessity for local levelling for the execution of works, and that the practical benefits to be derived from it are those which would result from using it as a means of projecting and setting out the schemes for intended new works. If then, a system of levels is to be adopted which is approximate only, and not strictly accurate in its results, it will be well to inquire whether, for those general purposes to which contours in national maps can be applied, a more practical and more economical system cannot be devised; and that which I should recommend for adoption would be a system of levels applying to the natural lines of the ground, viz. the watercourse and watershed lines, which, in combination with the lines of cliffs, and the lines of the sea coast and lakes, constitute the natural outlines of the ground. These are the lines which, in the application of art to the representation of the human figure, the painter and sculptor would first seek to establish; and these are the lines also which the practical engineer and topographer should equally desire to establish in dealing with the earth's surface.

In addition to these lines of levels, and in connexion with them, I would recommend, as is the present practice of the Ordnance Survey Department, to

run lines of levels and to fix permanent bench-marks along the principal roads. The course of procedure would be thus :—

From some trigonometrical station, the position and height of which has been established, and which may be presumed to be on elevated ground, a line of levels should be taken along the ridge or high ground to the nearest principal road, and thence along the road in both directions, bench-marks being fixed at the crossing of every stream or watercourse, on every summit level, and at well-selected points near to any sudden rise or fall of the ground. Then, from the chief eminence, a line of levels should be run along the descending main ridge or ridges, down to the main vallies or watercourse lines. The lines of the main vallies, rivers, or watercourses should also be levelled, and the levels continued upward to the main ridge or summit; and the principal streams which branch from the main watercourses should in like manner be levelled, and the levels continued upward to close and check on the main ridge line. Other lines of levels should be run from the main ridge line downward, along the high ground, or spurs, between every two streams, to close and check in the main valley line; and, in addition to the checks afforded by the main ridge and main valley lines, there would be the checks also of the bench-marks in the principal roads.

Neither for this operation, nor for contouring, would it be required that the levels should be taken during the progress of the outline boundary and field survey. The two operations are perfectly distinct, and would be prosecuted at different times.

We may assume, therefore, that the outline field survey would first be completed. The road leveller should then have a tracing supplied to him of the roads which, in the judgment of the survey officer, it would be desirable to level for the establishment of permanent bench-marks; and the position and height of some trigonometrical station should be given to him as a starting point. The position of every other trigonometrical station in the near neighbourhood of the road should likewise be supplied to him, to be used as closing points; but the previously ascertained heights of these stations should be withheld from him, and be used as checks upon the accuracy of his work.

The road leveller being supplied with a tracing of the lines of road, showing the houses and fences abutting upon them, would not require to resort to any chain measurements, but would select for his stations the abutments of fences, houses, bridges, milestones, gate-posts, and other points determined by the previous survey. In like manner also, for the watercourses and spurs, the leveller being supplied with a tracing from the finished outline plans, showing the position of the bench-marks previously ascertained, would proceed to determine the height of the angular points formed by the junction of fences with one another and with streams, which points, being all previously shown in position upon the tracing, would render further chain measurements unnecessary. The actual lines to be levelled should in these cases also be selected and determined by the judgment of the survey officer, or by some superior assistant conversant with the ground.

Thus, the entire operation of traversing for the contours, together with the attendant chain measurements, and the whole of the office work in laying down those traverses on paper, would be saved by the process I have suggested. In the district referred to at page 350, the lines to be levelled would be 84 miles in length, or less than one sixth of the linear measurement of the contours; but as no chain measurements would be required, and the operation would consist in merely setting up the spirit level and taking the back and forward readings at the several stations, the cost of the field-work would certainly be reduced by one half, and the entire cost should be about one twelfth only of the cost of instrumental contouring.

The information obtained by it would also be more definite, the points being all found readily upon the ground without measurement, and being such as the practical engineer should receive as sufficient guiding points for his works. The intervening connecting lines, to complete the contours, he would approximate upon the plan, and, when requisite, would trace upon the ground for himself. But the fact is, that he very rarely requires them; the lines of his works are seldom a dead level throughout, but more or less inclined to the horizon, and all that is essentially requisite for him is to be supplied with a certain number of guiding points. If he has to form a communication between two towns on

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a flat plain he has no need of levels at all; if the plain be evenly inclined throughout, a single level or height at each extremity will be sufficient; if the surface be inclined transversely, and undulating and broken by ravines, he requires to know where to cross the rivers and the spurs. All this information the levels or heights applying to the natural lines would supply.

For the purposes of land drainage, what the engineer chiefly requires is a proper outfall, and for this purpose accurate and well-defined levels along the course of rivers and streams are of paramount importance. The depth of the bed of the watercourse will also be required for his operations at the junctions of streams and at their ultimate outfall; but this he may obtain for himself if a sufficient number of well-defined heights are furnished along their course. The lines of the contours are of use to him only as an indication of the boundary of the area or district to be drained by any particular outfall; he would not desire to carry his drains along the contour lines, and would not trust the contour lines if he did. An approximation to the contour line is all that he really requires, and that he would obtain sufficiently for his purpose from the heights marked along the watercourses and spurs. More specific information he would, under any circumstances, desire to obtain for himself.

A large discretionary power should be exercised in selecting the particular lines to be levelled, and in prescribing and limiting the areas or districts to which different degrees of precision should be assigned. The area within the limits of cultivation is that which calls for special attention, say up to 1,000 or 1,200 feet of elevation above the sea. Over the still more elevated districts only occasional indications of altitude can be required, and these may, for the most part, be made to apply to natural forms and casual objects selected by the judgment of the survey officer, and established in position by the previous survey. In some exceptional cases only, in such localities, should it be requisite to resort to chain measurements, which should then always be sparingly applied. And it appears to me, that any increased amount of remuneration which might be deemed requisite to secure the exercise of a sound judgment and discrimination, in limiting the operation and guarding against a useless and wasteful expenditure of labour in such cases, would be a wise and wholesome economy.

Even in the upper or more elevated portions of the cultivated districts, the requirement of frequency in the levels would admit of some limitation; and everywhere a judicious selection of the watercourses should be desirable, in choosing those only which are the natural boundary lines of the principal features, to the exclusion of the minor streams, as the fluctuations, in the contour lines, caused by those minor watercourses, would readily suggest themselves to the mind of the scientific and practical inquirer.

Contouring, applied to hill-delineation, as the sole means of producing a representation of the physical relief of ground, is—even in its fullest development—absolutely erroneous in principle; because it assigns increase of shade to increasing inclination or steepness of slope, without reference to the elevation of the ground; and, as a consequence, the greatest intensity of shade must frequently appear on the lower grounds, where it is least wanted and most objectionable; that is to say, the contour lines, which are all supposed to be of the same strength, by approaching closer to one another, and blending with one another on precipitous slopes, produce the appearance of a darker shade, which will be of the same intensity whether the feature be at 100, or 1,000, or 3,000 feet above the level of the sea. This is altogether at variance with the principle of transparency, which is declared to be of paramount importance in hill shading and engraving, (a) and which can only be attained by the artistic and pictorial mode of procedure. By that process, which combines the principle of aerial perspective, the draughtsman, viewing the district mentally, as from above, treats the summits as the foreground of his picture, and the low grounds as the distance; and thus, while he is enabled to be lavish with dark shades and powerful contrasts over the mountain regions, where there is no detail to be obscured, the cultivated lower districts will never in tone exceed a half-tint. This I believe to be the true principle of hill portraiture; and although the general taste of the public may not yet be sufficiently cultivated and matured to appreciate and accept it in its fullest extent, it is what the progress of science and art at the present day calls for, and what the eye and hand of good taste should

(a) Report from the Select Committee on the Map of Ireland, 12th August 1853, page 4.

supply in a national work of art, such as the Ordnance one-inch map essentially is. In its present state we may safely challenge the world to produce such another piece of existing topography; but it is by no means perfect, or what it might have been if the progress of the engraving department had kept pace with the drawing of the existing plans. How, then, is further improvement to be effected, and perfection to be attained? Most assuredly not by retrograding, and adopting a purely mechanical process. Such a course would be unworthy of an enlightened Government; and the subject, in my opinion, requires only to be clearly understood to obtain for it a sound practical decision.

Chantrey was fully alive to the importance of this subject,—than whom, no man could be better qualified to form a correct judgment upon it. He entered warmly into the consideration of it with Mr. Dawson; was always accessible; and in the numerous interviews which I myself had with him he clearly expressed to me his views, which I then sought to carry out, with General Colby's concurrence, in the hill-drawing department of the survey of Ireland. Chantrey was of opinion that a scale of shades should be established, combining as many gradations of tone as could clearly be apprehended by the eye. Some five or six, it was thought, might be sufficient, and these assigned to districts or zones, ascending by 500 feet on the vertical scale, would suffice for the representation of mountains of 3,000 feet, or the highest ground in the kingdom. The application of the principle would require the lowest flat ground to be absolutely white; that the tone of the lowest shade should nowhere be exceeded for ground under 500 feet of elevation; that the tone of the second shade should not be exceeded for ground up to 1,000 feet; nor the tone of the third shade up to 1,500 feet. Above that elevation, and fairly beyond the limits of cultivation, more license might be allowable; and for the highest ground, any depth of tone that the artist could desire might safely be permitted. The stages were not fixed absolutely at 500 feet each, and it will be seen by what has been stated, that six stages would admit practically of closer intervals, or that fewer stages, say four or five only, would be requisite.

The preparation of a scale of shades on this principle was undertaken by me in 1829-30, when, by General Colby's appointment I took charge of the hill-drawing department in Ireland, and a general drawing of the island was commenced by me, but never completed. My withdrawal, and subsequent appointment to civil Survey duties in this country, caused the project to be abandoned.

As a guide to the hill-sketcher on the ground, the occasional instrumental contours are unnecessary, if a proper system of hill-sketching be pursued; and certainly not worth the attendant expense. I state this as the result of my practical experience in Ireland, where the gentlemen employed with me sketched the entire counties of Derry and Antrim, and portions of Down, Armagh, and Tyrone. The system pursued by us was that practised by Mr. Dawson in Wales. The hill-sketcher was instructed, as he passed over the ground, to observe at every change of position the line of greatest declivity, and the hachures which he made to indicate the slope were drawn at right angles with that. Thus, numerous short lines would be drawn, which, with a slight extension either way, would connect with one another, and form approximate contours. They were not traced instrumentally; and would not be drawn at a uniform vertical distance apart; nor would care be taken to connect them rigidly with one another, so as to make them strictly continuous; but, when drawn even at moderate intervals apart, their continuation and connexion would be so obvious as to leave little more to be desired.

As a test of the accuracy of the work, it was customary to select some one of the definite altitudes, marked by figures upon the map, and to trace with red ink the horizontal line passing through it, and the other lines in continuation of that one, and so, by constituting an approximate contour line, to arrive again at the point of departure, or at points of like elevation on other parts of the sheet. This system of sketching, in contradistinction to the older method by vertical hachures, has been styled the horizontal system, and it is virtually a system of practical contouring.

The hill-sketchers, by study at other times from well-selected models of hill forms, were trained to apprehend the forms rightly, and to work with great precision; and by strengthening their lines, or applying them at closer intervals in particular cases to note a greater declivity, they were enabled to produce a

far more faithful representation of the surface of the ground than instrumental contouring could ever practically accomplish.

It will be seen that a strong line of distinction is here drawn between the duties of the hill-sketcher and the hill-draughtsman. To the hill-sketcher every separate feature, however small, is an object of special study, and the shading used to express it has reference to the inclination of its slopes, in comparison with those of other features in the limited field of the sketch sheet on which he works. Thus, he may keep the tone of one sketch sheet very light, and make the adjacent sheet very dark, and both shall be correct within themselves, though representing precisely similar elevations; or very possibly the darker sketch may belong to the lower ground, and still be perfectly correct within itself. The province of the draughtsman, however, is more comprehensive. He has to compass in his imagination the larger masses and assemblages of forms, assigning to individual features only their subordinate and relative importance as parts of the general whole, and the tone only which properly belongs to them in the scale of aerial perspective. This will explain the true cause of the failure of the Derbyshire sheets, produced before the Scotch Survey Committee, (Questions 1534, 1536)—those sheets having been compiled for the engraver, from the sketches of various assistants, by a person who had not a comprehensive and accurate apprehension of the assemblage of forms which he was employed to portray.

The attempt to effect hill-delineation by simple contours alone, or by hachures at right angles with those contours, applied in the office, without going upon the ground to hill-sketch, must therefore,—and I again assert it most confidently,—be an absolute failure.

Either system, if carried out to the fullest extent, must be positively injurious by obscuring the detail of the map, and unless the contours were drawn at such close intervals as to make them highly objectionable on the score of expense, they must of necessity fail to represent that extensive class of minor features and breaks which give a distinctive character to different portions of the earth's surface. It is the texture and folds of Earth's vesture, so to speak, which no system of instrumental contouring can exhibit; nor is it in the power of human machinery to produce it; nor will the picture be perfect without it. It is this truthful characteristic expression of the surface of the ground which is wanting, even in our best maps, to make them acceptable and satisfactory to the man of science and of taste. The best foreign maps are wholly deficient in it. They are either purely conventional, or the forms represented in them are naked and lumpy, like the lay-figure, when dependent on contours. The Welsh maps alone make an approach to it, and their failure is due principally to want of correct apprehension and artistic skill in the engraving department. Those maps are the result of a life of unusual activity and intelligence applied in the right direction, as attested by Chantrey; and there is no one whose judgment on such a subject is entitled to greater consideration. They have awakened in the geologist a perception of what is required; and as improvement takes place in the art itself, the taste to appreciate it will be more widely disseminated. The public cannot be expected to acquire a taste for it, and rightly to appreciate it, until it is submitted to their judgment in a full and satisfactory shape, which a well executed National Survey alone can accomplish.

As a recapitulation:—It has been shown that Contouring can be useful for works, only when carried out with a degree of precision, and to an extent, which would render its adoption for a National survey perfectly unjustifiable;—that in its modified form it is a very expensive process; and the practical benefits to be derived from it are confined to the mere Projects for works;—that, as applied to the Delineation of the physical features of Ground in maps, it is faulty in principle and ineffective;—and that these are not mere speculative opinions. The superiority of the pictorial mode of expression has been exemplified and admitted in the Welsh maps;—and, with reference to engineering works, a system somewhat analogous to that herein proposed is frequently resorted to for railways and other works, and known as the system of "Surface Levels." Levels applying to the natural lines of the ground should be equally effective for those purposes;—and they are, in fact, all that private Companies and individuals should properly require for their projects; and all that the Government should be expected to provide at the public expense.

No. 4.

Sir C. TREVELYAN to Mr. C. VIGNOLES, C.E.

Contouring
and
Hill Delineation

Treasury Chambers, 24th December 1853.

I request that you will do me the favour to read the enclosed papers attentively and then to state your opinion—

1. Whether the system of instrumental Contouring, as exhibited on the 6-inch maps of the Ordnance Survey, can be considered, in its practical application to engineering and other scientific purposes, to justify its probable cost to the public?

2. Whether the practical benefits to be derived from it might, as expected by Colonel Dawson, be obtained, to a sufficient extent at least, by a system of Surface Levels applying to the natural lines of the ground, and at a very considerably less cost?

No. 5.

Mr. CHARLES VIGNOLES to Sir C. TREVELYAN.

21, Duke Street, Westminster,
30th December 1853.

I HAVE had the honour of receiving your letter of the 24th instant, requesting me to consider the documents therewith sent, and then to give my opinion,

(a.) Whether the system of instrumental Contouring, as exhibited on the 6-inch maps of the Ordnance Survey, can be considered, in its practical application to engineering and other scientific purposes, to justify its probable cost to the public?

(b.) Whether the practical benefits to be derived from it might, as expected by Colonel Dawson, be obtained, to a sufficient extent at least, by a system of Surface Levels applying to the natural lines of the ground, and at a very considerably less cost?

Although very desirous of sending replies as concise and as categorical as possible to these important and interesting questions, I am obliged to commence with a few observations, as the necessary basis for my answers.

Every argument that could be advantageously brought forward as to the relative merits of Contours and of Surface Levels has been condensed in the excellent papers of Major Larcom and of Colonel Dawson; and, were the question of the expense of both systems positively known, and what was to be really done for such cost, there would then exist all the data requisite to base my replies upon, and to justify them. It is, however, on this very question of expense that my opinions have been asked for, and on which, to some extent, they depend.

I have had very considerable experience in the application of both systems to engineering purposes, but more especially of the system of surface levels, and for very many years have always had recourse to the latter, when I could not obtain contours,—which, indeed, only exist on the continental maps,—and I can form a pretty accurate estimate of what the cost of surface-levelling would probably be; but I confess I am unable to speak as decidedly of the expense of contouring; thus much, however, is certain, that to give mathematical authenticity to contours, and to lay them down to a sufficient extent, and so that the practical engineer may make use of them readily and with certainty, would be very expensive.

I apply myself, nevertheless, to the material part of the inquiry: To what extent can each system be relied upon as “practicably applicable to engineering;” to which purpose I wish to limit my reply.

It is admitted by every one, that no system of contouring, unless carried out to an extent inadmissible on account of the cost, could dispense with *local levelling*, of greater or less extent, for specific objects; and that it could not either dispense with the *hill shading*, by competent draughtsmen going over the ground. But there is this important difference, that contours alone, even to a

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much less extent than what is proposed, would be quite sufficient to form an authentic basis for the hill shading; whereas contours are not in themselves sufficient to afford accurate points and data wherefrom to start, for local and special purposes. It has consequently been conceded, that, in addition to the normal contours, interpolations are often expedient, surface levels to some extent generally necessary, and bench marks always indispensable.

An engineer may be able to trace the general direction for a road or railway from the well-executed sheets of the Ordnance maps on the 1-inch scale, but he must himself go over the ground. With a contoured map he could do the same thing much better in his cabinet;—for canals, water-feeders, drainage, water supplies, &c., the hill shading is of little use, compared with contours. Both apply only to sketching out the general idea and outline; and special levelling can seldom or ever be dispensed with.

The degree of value, therefore, of contouring to the practical engineer, depends on the accuracy with which, and the scale whereon, the contours are laid down. Without knowing anything at all of the arrangements, I could venture to say of the specimen sheet of the Ordnance 6-inch map now before me (Yorkshire sheet, 147), that, as seems evident on its face, the instrumental contours have been actually angle-traversed, chained, levelled, and plotted; and the intermediate contours obtained by interpolations of a less strictly accurate character—that is, not all laid down on the map from lines chained, angled, and plotted; and very properly so, because such is not needed when the scale is not larger than that of six inches to the mile.

The sides of the triangles, as levelled and marked on the same map, show points which are really surface levels; yet there are very few bench marks on it from which the engineer can start. But the chief practical non-applicability of the lines (even instrumental contours) as laid down on this map is the difficulty—I might almost say the impossibility—of identifying on the ground itself, the lines drawn on the map, without complicated measurements; and consequently they do not much help the engineer, beyond enabling him to trace a trial line on the paper.

In a mountainous country, such as hereon shown, there are few or no houses, fences, roads, or objects intersected by the contours. In a less elevated and less rugged district, the contours, at intervals of 25 feet of vertical height, will be less and less useful for local purposes, as the mountains sink into the plains; and in flat districts, the contours would be almost useless, and surface levels and bench marks alone applicable; the latter especially. Except for water supplies and draining, the practical engineer is only occasionally, in this country, found operating at heights which exceed 500 feet above the sea. He is always wanted, more or less, in the flat districts.

I am at this moment engaged in laying out extensive lines of railway through the lower districts of Switzerland, where the whole country is contoured at vertical intervals of eight metres (about 26½ feet); but, owing to the small scale of the map, viz., 1 in 25,000, or about 2½ inches to the mile, and to the total absence of determinable bench marks, I find nearly as much practical benefit from the surface levels—not very numerous—as from the contours.

I have on several occasions laid out roads and railways from the surface levels on the 6-inch maps of Ireland, nearly, and perhaps quite, as well as if the contours had been drawn in. But the best practical proof of the advantages of surface levels is in the use made by engineers and architects of the Ordnance map of London, on the scale of 12 inches to the mile, (1 in 5,280, of which it may be said, *en passant*, that a scale of 1 in 5,000 would have been more mathematical), with the numerous surface levels and bench marks, all of which can at once be identified, referred to, and employed as data and starting points, not only for local purposes, but in many instances without need of any other preliminary levelling; whereas contour lines would have been, comparatively, of little service.

I write these observations in great haste, and just on the eve of starting for Switzerland; but should this inquiry still remain open at my return to London on the 16th of January, I should be glad of the opportunity of explaining my views and conclusions more fully before any Commission which may be deputed

for investigating this important question. In the meantime I will conclude by answering the preceding questions.

(a) The system of contouring, as exhibited on the 6-inch maps of the Ordnance surveys, in its practical application to engineering purposes, is not justified by any great cost; but, if it could be accomplished at a moderate expense, it would be highly interesting, and justifiable in its applicability to other scientific ends and purposes, besides engineering; and it forms a most admirable basis for hill sketching, and for correctly expressing to the eye the surface of a country.

(b) So far as practical benefits to the art of engineering can be derived from the system of Contours, I consider, as expected by Colonel Dawson, that the same might be obtained, to a sufficient extent at least, by a system of Surface Levels, and at considerably less cost.

I will add, in conclusion, that a combination of the two systems might readily be arranged, and that the multiplication of bench marks and surface levels at places where they could easily be identified within a few inches (as on the Ordnance maps of London), would produce the most perfect system, and the one best adapted for *all* purposes; and I think such might be accomplished within the limits of an expenditure justifiable. I should be very sorry indeed that the system of Contours should be wholly abandoned; but I am obliged to say, that, for the purposes of the civil engineer, if a choice has to be made between the two systems, I decidedly would recommend the preference of that of Surface Levels over that of Contours.

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No. 6.

MR. CHARLES VIGNOLES to SIR C. TREVELYAN.

Western Railway of Switzerland,
Geneva, 6th January 1854.

SINCE I had the honour of addressing you on the 30th December last, I have had the opportunity of obtaining some interesting and authentic information on the actual cost of *contouring* the topographical Maps of Switzerland, and also the cost to a Railway Company of contouring a very extensive area of broken country in France; and I take the liberty of inclosing the original letters I have received, with the replies to the inquiries I had made. You will at once perceive that the expense is nearly as the scale to which the Maps are laid down.

The measures and money are given on the decimal system in use in France and Switzerland, and reduced to the English usages, as they are represented below. I could, if it were considered desirable, obtain further information, especially as regards the Canton of Geneva, which has been contoured at vertical intervals of only *two* mètres (about $6\frac{2}{3}$ feet), with numerous bench marks, and laid down on a scale of $\frac{1}{12500}$ (about 5 inches to the mile); but, as I understood before leaving London that the question as to applying the system of Contours to the Ordnance Maps of the United Kingdom would be immediately decided, I considered it right to send you at once what I was able to collect.

ABSTRACT of COST of SWISS and FRENCH CONTOURS.

Vertical Intervals of the Horizontal Contours.		Horizontal Scales of the Maps.		Cost of Contouring per	
Mètres.	English Feet.	Decimal.	English.	English Square Mile.	English Acre.
30	100	$\frac{1}{12500}$ $\frac{1}{25000}$ $\frac{1}{50000}$	1½ inch per mile.	£ s.	d.
10	33		2½ inch per mile.	1 10	0 $\frac{30}{100}$
10	33		25½ inch per mile, or 3½ chains per inch.	2 10	0 $\frac{60}{100}$
	nearly.			11 0	4½

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Inclosure 1 in No. 6.

(Translation.)

The topographical examination of the ground between Bellegarde and Fort l'Ecluse, of which you this morning wished to know the precise cost per given area of surface, appears to have required an expense as stated below.

The hectare of 10,000 square mètres (about 11,960 square yards— $2\frac{1}{2}$ English acres nearly), came to fr. 1.087 (one franc nine centimes) [$10\frac{1}{2}$ pence sterling nearly, or $4\frac{1}{5}$ pence per English acre].

The above cost does not include plan work, properly so called, but only the operations of levelling required on the ground, and the reduction of these levels upon the cadastral maps, by means of heights referred to the sea level, and laying down the horizontal contours at equal vertical intervals of 10 mètres (33 English feet), which was done by the comparison of the heights noted, and by attentive examination of the ground, with the plans in the hand.

No doubt the above may be taken as a maximum cost, as we had to deal with extremely rough ground, and a total difference of level of 440 mètres (1,452 English feet), the lowest height being 305 ($1,006\frac{1}{2}$ feet), and the highest 745 ($2,658\frac{1}{2}$ feet), and consequently the laying down of 44 contours on a plan to the large scale of $\frac{1}{25000}$.

(Signed) SCHLEMMER,
Engineer of Ponts and Chaussées in the service
of the Lyons and Geneva Railway Company.

Geneva, Friday evening,
6th January 1854.

Inclosure 2 in No. 6.

(Translation.)

NOTE of the exact Cost of contouring the Map of SWITZERLAND.

1°. On the scale of $\frac{1}{25000}$.

The square league (conventional) of 5,000 mètres on each side, viz. of twenty-five millions of square mètres, including the angles and contours by horizontal curved lines at equal vertical intervals of *ten* mètres (about thirty-three feet English), costs the State about *six hundred francs*; which gives as the cost price of the English mile of 1,609 mètres, about *sixty-one francs* (fifty shillings sterling).

2°. On the scale of $\frac{1}{50000}$.

The same square league, including also the angles and contours by horizontal curves at equal vertical intervals of thirty metres (about ninety-nine English feet), costs about *three hundred and fifty francs*; the cost of an English mile on this scale is therefore *thirty-six francs* (thirty shillings sterling.)

For General Du FOUR,

Director of the Map of Switzerland.

(Dated)
Federal Topographical Office, Geneva,
4th January 1854.

(Signed) BÉTEMPS,
Geographical Engineer.

No. 7.

THOUGHTS ON PLAN-DRAWING, with particular reference to the Representation of the Physical Forms of Ground in Topographical Maps. By Mr. ROBERT DAWSON, late of the Corps of Royal Military Surveyors and Draughtsmen.

This kind of drawing has hitherto been regarded in a low light as a branch of art, and accordingly has been practised, mostly, under mechanical methods and arbitrary rules; but, as it requires mental apprehension, and is capable of giving mental satisfaction and pleasure, in connexion with natural science,—as well as of conveying much useful information for general demands and purposes,—it should be regarded in a higher and more liberal sense; and therefore it is desirable to bespeak, and obtain for it, the attention and judgment of professed artists, to carry it to perfection. In the meantime, being asked my opinion, as a surveyor and draftsman, on the subject, I proceed to give it by stating, in the first place, what I think a topographical map is, or should be considered.

Pictorial or
Natural History
Plan Drawing.

By a topographical map, then, I should understand a full-face, *pictorial*, representation of a place, district or country, in its natural figuration of mountain, hill, valley, and plain,—with its coast and river boundaries and divisions, and the artificial lines, figures and tracery belonging to the surface, geometrically described on it;—the whole united harmoniously in one pictorial exhibition to the eye. It should be such as to exemplify Dr. Arnold's geographical idea of a country, as recommended in his lectures on the study of history, where he says: "A real knowledge of geography embraces at once a knowledge of the earth, and of the dwellings of man upon it. Let me once understand the real geography of a country,—its organic structure, if I may so call it,—the form of its skeleton, that is, its hills;—the magnitude and course of its veins and arteries, that is, its streams and rivers; let me conceive it as a whole made up of connected parts,—and then the position of man's dwellings, viewed in reference to these parts, becomes at once easily remembered, and lively and intelligent besides. For the sake of mere beauty and liveliness, if there were no other consideration, it would be worth our while to acquire this richer view of geography." "Conceive only (he says) the difference between a ground-plan and a picture—the mere plan geography of Italy." And then, describing part of Italy by way of example, he calls this, in comparison with a common knowledge of geography, "a giving life and meaning, and harmony to what is at present lifeless and confused." "I wished (he says) to give an example of what I meant by a real and lively knowledge of geography, which brings the whole character of a country before our eyes." Now this, I think, a topographical map may do more effectually and gracefully than has hitherto been accomplished, or exemplified in the best published maps of the present day.

Drawing, in its application to maps, or plan drawing, is not confined to delineation only, but to the whole expression of form in respect of ground. It is *natural history* drawing of land in full perspective perception—the greatest subject for that kind of description,—and, for its successful accomplishment to satisfy the eye and mind conversant with land in its map aspect, it requires the ordinary graphic qualification of the artist, combined with some knowledge of physical geography and geology, and a clear and perfect mental apprehension of the details of the subject, embodied and harmonized as a whole.

Pictorial effect in maps is the expression of whole forms, and assemblages of forms, to the eye, in one whole imaginative view, which must be taken by appropriate surveying, and drawn with artistic judgment and skill. The drawing will be the same, or a parallel case, to that of bas-relief sculpture in full perspective of the plane surface on which it appears, for land may be apprehended and drawn as a great subject of natural sculpture, standing in bas-relief of the surface of the sea; but the apprehension of it must be mental and artistic; and the expression will be in bird's-eye and panoramic perspective of the forms, as they fall directly under the eye. The degree of art that may be used, both in surveying and drawing land in map aspect, is greater than seems to have been thought due to this kind of drawing, and therefore it is not to be found exemplified in the best modern maps, nor are the forms portrayed in those maps so satisfactory, and pleasing to the eye, as the most common natural history drawings of other subjects appear, even in books and prints for popular instruc-

tion. Those subjects, it is true, may be more familiar in idea,—better known and understood as objects of the animal and vegetable world,—and may please more immediately by direct resemblance,—and, in shape and colour, may be more attractive. They are also comparatively small subjects, and may be apprehended in single view. But there is an appropriate beauty in the forms of land, contemplated in map view, which a map may express, and which the means and resources of art, in the present day, may supply in a much higher degree than has been hitherto effected.

This higher degree of perfection is required for physiological geography, for topographical description, and for other purposes, professional, economical, and general. It has formed the subject of consideration for committees of the House of Commons, for the Ordnance Survey of Great Britain, and for Commissions under the French Government for their national survey; but the principle of natural history drawing has not been proposed by any of them, and though some manifestations of its practical application have been made in England, they have not been carried out to their fullest extent.

The *natural-history principle* will require the physical substance, and geological structure and formation of the land to be understood, in order to recognize and express those characteristic indications, which a survey of the land itself would give to the physical geographer and the painter. To form this mental perception, and to make the drawing after it, is the peculiar and great difficulty of the work; for while in the map the eye embraces the whole field at a glance, it is supposed to travel over the ground, and to be everywhere vertically fixed immediately over every part of it. Geometry must give the guiding points, but the drawing will not be a merely geometrical and mechanical process, though it may admit of, and require, mechanical drawing and conventional signs, writing, &c., to be added to it. Yet the whole may be executed in such pictural harmony, as to admit of the map being contemplated as a natural picture to the eye. This seems the proper principle to propose, and the artistic ability to require, for this kind of drawing. Under it, description for all purposes and demands, may be accurately and gracefully executed; and, taken as a rule of appreciation for the best published maps, much will be found wanting to bring them up to the standard.

This will not, however, be thought too difficult a task for the accomplished map-draftsman to undertake; natural-history quality of execution being all that is required, and this is known to employ not a very high pitch of artistic ability. Mountains and hills, in map-perspective, are not so difficult to draw in single forms, as many other subjects of natural-history drawing may be, particularly in oblique perspective; for geometrical perspective is the simplest possible, and, in this respect, presents no difficulty at all of mere delineation. It is the whole expression of a pictural idea—in light, and shade, and colour—that constitutes the artistic difficulty to be mastered.

Natural-drawing in maps, has been objected to, I am aware, as having too much of the painter's art in it, the object of which has been supposed more "to please the eye," than to give, as required in this case of topographical drawing, accurate and useful information; and so, liable to abuse in giving fanciful expression, rather than accurate intelligence; but this is arguing from the abuse of the painter's art, which is no more to be assumed for the topographical describer, than for the naturalist, who has acquired enough of the painter's art to describe his subject, whatever it may be, picturally. The same aims, end, and ability are necessary for both.—If it should still be thought, however, and contended, that map-drawing of all kinds is necessarily more geometrical than natural, and that neat and accurate delineation is better for it, and more useful, than pictural expression,—it may be answered, that both may be combined, that the eye demands natural drawing for natural subjects, and that it is, in fact, in some way or other, always attempted in maps of this kind; sometimes, indeed, absurdly; sometimes rudely and mechanically; and mostly in defect or exaggeration of nature, and artistic judgment of what is really wanted; yet the attempt which is made, and the demand, growing as it does with experience, and a comparison with the state of natural-history drawing for other subjects, seems to show that it cannot be given up, or left uncultivated.

The *natural-history principle*, then, I would propose for the aim and standard of the drawing, and the rule by which it may be appreciated. It cannot be expected that either the geodetical surveyor, or the ordinary land-surveyor,

should be an *artistic* draftsman, though in their proper measure, both may add this accomplishment to their respective abilities; yet it seems more properly to belong to the latter profession to cultivate it, than to the mathematical and philosophical ability which is occasionally called into action for geodetic operations. Indeed, the land-surveyor may aspire to the higher branch, perhaps, more consistently than the mathematician and philosopher may undertake the purely practical part of surveying and drawing for topographical purposes; for if the surveyor has talent and industry, he may study and learn to add geodetical surveying to the foundation of his business, as well as topographical drawing or portraiture, so to speak, to its finishing efficacy and grace.

Pictural or
Natural History
Plan Drawing.

Some geological knowledge of land generally, in its figuration, is necessary to apprehend and understand that of any particular country:—the general phenomena which appear in its surface forms,—the rising and sinking of land in circular and elliptical areas,—its formation under a covering sea, and emerging in volcanic forms out of it,—its division by rents and faults,—its crystalline and mechanical construction in beds and strata,—the shaping and denuding effects of floods and currents, cutting out and exposing its forms and features as we now see them. A map, drawn in advertence to these facts and deductions, must be particularly desirable for geological description and illustration.

M. Boué has shown that “a critical similarity of outward forms, while indicating similarity of producing causes, must also, to a large extent, indicate identity of structure; and, therefore, from the external appearance of an unexplored country,”—(and from a map properly representing it)—“its geological structure may be inferred, at least to a certain extent.

“Nature has not wrought after an indefinite number of types or models, but on the contrary, her fundamental types are few, and derived from the action of definite constructive forces on a primary base.” This reference to M. Boué is made by Mrs. Somerville, in her *Physical Geography*, 1848.

A great flood, over all the northern countries of Europe, may be assumed to have acted upon and modified their forms, from the traces of it observed in Russia and Sweden, by Sir Roderick Murchison. It may be no less evidenced by the forms and figuration of surface in the British Isles, or perhaps more so, when these have been sufficiently surveyed in relation to this great geometrical problem.

A glance at a geological map of England shows, a great curvilinear arrangement of its mineral masses, on the east of Wales and Cumberland, which the topographical map, in its description of the symmetrical surface forms, should express comprehensively to the eye. Mr. Hopkins, in his paper on the Lakes District, read before the Geological Society, June 6, 1842, assumes the elevation of those masses to have thrown up the incumbent formations at the same time; hence the ringy disposition, in horizontal order, of the mineral masses, and the rib-like forms of their surface structure; the hollows forming the channels by which currents of the northern flood passed over the land in a south and south-west direction. The impinging force of the flood is seen in the coast-like escarpments which front the north, the remarkable figuration of the oolite beds affording a curious example. Mr. Darwin's paper, on the connexion of volcanic phenomena and the formation of mountain chains, read before the Geological Society, February 7, 1838, seems to afford ground for assuming that the curvilinear order of figuration in England has been produced by this cause, and that it has been the foundation of coralline rings, of which the oolitic beds are the remains.

A surveyor, seeking to qualify himself for drawing the *natural* figuration of land in a map, should acquire first, a power of figure-drawing (the human figure) with that truth of form and character which may mark, at least, the physical distinction of natural races. He should apply then to landscape drawing, in that perspective which approaches nearest to the plan view; and in addition to mere manual skill, in delineation and colouring in relief, he should learn enough of the principles of pictural art, for his government and use, and study their application from paintings which furnish examples of expression coming nearest to that for which he wants instruction and guidance. He may draw from solid models too, which are to be met with in stones, heaps of earth, knots in the stems of trees, the waves of agitated water, and other natural forms which resemble those of land so much that both are described by a common term of resemblance. Models taken on purpose, and cast in plaster,

may be used; but I think natural models, such as I have mentioned, will be sufficient, and indeed the best. Mathematical solids resembling mountains and hills, as the cone, pyramid, and segments of the sphere and ellipse, with a horizontal plane for their base, may be referred to in idea on the ground, as typical forms, for ready whole apprehension, and nice distinction of the natural forms. A nomenclature for the natural forms of land, founded on their similarity to the pre-conceived types, will assist the perception of geometrical, under actual perspective, and be of great advantage in description and reference by words.

The table-hills about Bagshot, Chobham, and Farnham, must be familiar to many observers of the late encampment at Chobham; and to some, with me, who witnessed that on Bagshot Heath, and the other places south of Windsor Forest, in 1792. The table-hill, divided diagonally by an inclined plane, passing from the higher edge on one side, to the lower on the opposite, gives a wedge-like, or shelving form, to the lower segment;—its natural type is the running and surging wave; and both are common forms in sand and gravel hills, and other loose earths, from the low shelving banks and beaches of a seacoast, to the highest table and shelving lands of the world. Our *edge* hills, as several are called, besides that of the battle, (Edgehill,) are of this species. Mountain-limestone hills of the carboniferous system, are bold examples of this form—trap-hills, the silurian and old red sandstone hills, &c. Mr. Nichol describes a range of this kind of hills, extending from St. Abb's Head to near Port Patrick, in his paper read before the Geological Society, January, 1848. "The most remarkable physical feature " of "this district (he says) is the mountain chain which extends from St. Abb's Head " on the east coast, in a west-south-west direction, to the vicinity of Port Patrick " on the opposite side of the island, a distance of 140 miles, with an average breadth " of 25 to 30 miles. This high land consists less of a single connected chain than " a group of smaller ridges, separated by longitudinal valleys, running parallel to " the chief direction of the mass. These ridges and valleys are crossed almost at " right angles by another system of valleys, in which many of the secondary " streams flow. By these two systems of valleys the high land is divided into " huge oblong mountain masses, often with steep declivities and flat, or almost " tabular summits. When seen from the low ground, the mountains have thus " apparently a very complex or irregular arrangement; but whenever a proper " view is obtained from the high grounds"—(a map view)—" their disposal in " parallel ridges is distinct. The whole eastern portion of this extended mass " of mountains is composed of greywacke and clay-slate. In the south of Scot- " land these formations cover a space of more than 4000 square miles, or the " twentieth part of the whole island, and have thus a considerable geographical " importance." A general wedge-like shape, as I take it, composed of a series of smaller wedges, and the whole under escarpments more plane than rounded, consequently presenting angular partitions of faces, and natural lines of whole-figure boundary, which, in map-drawing, is commonly the most defective part of their delineation, and yet should be most strongly marked.

This description of land-forms, by words, and other descriptions, such as Mr. Hugh Miller's, in his *Old Red Sandstone*, seems vastly short of the defined and accurate expression which pictural map-drawing can give, expressively and immediately, to the eye. Nevertheless, Mr. Miller expresses, in words, pictural ideas of land most delightfully. "Physiognomy is no idle or " doubtful science in connexion with geology. The physiognomy of a country " indicates almost invariably its geological character. There is scarce a rock " among the more ancient groups that does not affect its peculiar form of hill " and valley. Each has its style of landscape"—(and plan-shape and style, too),—"and as the vegetation of a district depends often on the nature of the under- " lying deposits, not only are the main outlines regulated by the mineralogy " of the formations which they define, but also in many cases the manner in " which these outlines are filled up. The colouring of the landscape"—(and the plan)—"is well nigh as intimately connected with the geology as the " drawing." The rest on this subject, in the 11th chapter, is highly remarkable for power and beauty of landscape apprehension; and its transposition into map-apprehension, is a fine lesson for the map draftsman to take and illustrate.

Ruskin, in his work on "Modern Painters," says, what the map-draftsman may take as addressed to him, to direct his study of natural form in *ideal* perception:—"The task of the painter in the pursuit of ideal form, is to

" obtain accurate knowledge of the peculiar characters of every species of
 " being, down even to the stone ; for there is an ideality of granite, and slate,
 " and marble. A bank of loose earth of any kind, that has been at all ex-
 " posed to the weather, contains in it features capable of giving high gratifica-
 " tion to a careful observer. It is almost a fac-simile of a mountain slope of
 " soft decomposing rock : it possesses nearly the same varieties of character."

" There is an expression about all hill lines of nature, but it is not to be
 " reduced to line and rule."

" Turner's early drawings are singularly instructive in definiteness and sim-
 " plicity of aim ; they are little more than exquisite studies in light and
 " shade."

This, I think, should surely be the draftsman's aim in expressing the forms
 of land in a map.

" All forceful shadow and play of colour surrendered for quiet uniform
 " hues of grey, and chiaroscuro of extreme simplicity,"—" proper for archi-
 " tectural drawings in relievo." This, I think, is exactly what I should say
 for the shading plans of ground in relievo.

The term *form* is not to be applied to the outline of bodies ; " it neces-
 " sarily implies light and shade ; no form whatever can be known to the eye
 " without its chiaroscuro,—that perfect and harmonious unity of outline with
 " light and shade, by which the parts and projections of the body are ex-
 " plained to the eye."

" The eye of knowledge is as a telescope to the common eye, by which
 " more is apprehended than is immediately seen." Thus forms of land are
 seen in their origin, composition, &c., to the cultivated eye.

" Truths of specific form are the first and most important of all."

Under such guidance as this, the map draftsman may both please the eye
 with pictural expression in grace and elegance ; and the mind, which must be
 his chief object after all, with the information and description it requires. The
 subject may not be always beautiful in itself, but in reference to circumstances
 and associations with what is interesting and important in the knowledge of
 ground, it may call for *artistic* description in a map, to convey it at least
 agreeably and satisfactorily to the eye ; and what is beautiful in a richly varied
 face of country may be beautifully portrayed.

It may perhaps, be remarked, that this view of topographical plan-drawing
 does not advert to military topography, a question which I might be supposed
 to entertain as a military surveyor. But my object was to consider the subject
 of topographical drawing as comprehensively as I could, for all services and
 demands ; and natural-history description of ground, in geometrical, physical,
 and pictural quality drawn, seemed to me to compass the proposition. The
 cause of this kind of drawing being behind other kinds which have the same
 general object is, that it has been practised chiefly for professional uses, and
 science has been more regarded as necessary for it than art. Accordingly, the
 artistic education and direction of the draftsman has not been adequately pro-
 vided. He has not been prepared and required to address the mind with that
 knowledge of nature and art which is due to the subject, and to the observer
 who seeks information and gratification from the map-picture.

The draftsman's art is to do justice to nature, and the engraver's to do
 justice to the draftsman ; on neither should rules and methods be imposed,
 except by superior artistic judgment, in the employments of each respectively.

I have, &c.

Woodleigh, Devon, May 24, 1854. (Signed) ROBERT DAWSON.

To Sir Charles E. Trevelyan, K.C.B.,
 &c. &c. &c.

Appointment of
a Committee and
the Result.

APPOINTMENT OF A COMMITTEE ON CONTOURING

AND

THE RESULT.

No. 8.

TREASURY MINUTE, *dated May 23, 1854.*

My Lords have before them their Minute of the 7th February last, in which they observed that a question of much importance, namely, that of the advantage of applying a system of contouring to the Ordnance maps, had not been sufficiently developed in the recent correspondence with reference to scales, to enable them to form an opinion whether it would be desirable to have contour lines, or any substitute for them, laid down upon the maps; and that it appeared to them that this question could best be determined by a Committee of eminent persons, accustomed to the consideration of subjects of this description, and therefore capable of giving an independent judgment upon the various points at issue.

My Lords are accordingly pleased to appoint—

The Earl of Ellesmere,
Lord Wrottesley.
Sir John Burgoyne.
Sir Roderick Murchison,
Sir Henry De la Beche,
I. K. Brunel, Esq.,
J. M. Rendel, Esq.,
C. Vignoles, Esq., and
Professor Gordon,

to be members of a Committee for the purpose of investigating this subject, and reporting their opinions to this Board,—

1. Whether the advantages to the public to be derived from the exhibition of contour lines on the Ordnance maps are commensurate with the cost of their production; and

2. Whether the advantages which are derivable from this system may or may not be attained to a sufficient extent, and at a considerably less cost, by the adoption of any other process.

My Lords are also of opinion that the Superintendent of the Ordnance Survey, or his Executive officer, and Lieutenant-Colonel Dawson, should be in attendance on the Committee, in order to furnish any requisite information on the subject.

Transmit a copy of this Minute to each member of the Committee, together with a copy of Lieutenant-Colonel Larcom's letter, dated 7th November, and Lieutenant-Colonel Dawson's letter, dated 15th December last; and convey their Lordships' request that they will undertake the investigation of the subject, and meet at the earliest day that may be convenient to them.

Transmit a copy to the Secretary to the Ordnance, and request that he will move the Master-General and Board to give the requisite instructions to Sir John Burgoyne and the Superintendent of the Ordnance Survey, for the purpose of carrying out their Lordships' intentions as described therein.

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No. 9.

Lieut.-General SIR JOHN FOX BURGOWNE, G.C.B. to SIR C. TREVELYAN.

Office of Ordnance, Pall Mall, 6th June, 1854.

At the desire of the Committee appointed by the Lords of the Treasury to take into consideration certain matters concerning the question of Contouring as applied to the Maps of the Ordnance Survey, I beg to be informed on what scales are to be the maps, to which the question of the propriety and mode of Contouring refers, as the Scale must have great influence on the decision.

I am also directed to request to be informed whether the adoption of any system of Contouring will affect the speedy completion of the One-inch Map.

No. 10.

TREASURY MINUTE dated JUNE 6, 1854.

Write to Sir John Burgoyne that My Lords have had before them his Letter dated the 6th instant, inquiring, on behalf of the Committee which has been appointed to consider certain matters concerning the question of Contouring as applied to the Maps of the Ordnance Survey.

1st. On what Scales the Maps are to be published to which the question of the propriety and mode of Contouring refers, and

2dly. Whether the adoption of any system of Contouring will affect the speedy completion of the One-inch Map.

In reply to the first of these question, My Lords request that Sir J. Burgoyne will inform the Committee that as the One-inch Map will be published for the whole of the United Kingdom, and a Separate Map on the Scale of Six inches to the Mile will be completed for a considerable portion of the United Kingdom; and, as regards the unsurveyed portions of the North of England and Scotland, the question of the adoption of a Scale not less than 24 inches to the Mile and not more than 26 $\frac{2}{3}$ is now under consideration, it will be advisable that the Committee should report upon the question of Contouring in reference to each of the above-mentioned Scales.

In reply to the second question My Lords can only state that the object at present in view is to ascertain what mode of conducting the Survey would be attended with the greatest public advantage; and, after this has been determined, the progress of the work must depend upon the funds which it may be practicable to apply to this Service.

No. 11.

REPORT OF THE COMMITTEE ON CONTOURING.

Office of Ordnance, Pall Mall July 20, 1854.

To the Lords Commissioners of Her Majesty's Treasury,

Having been appointed by Your Lordships to be Members of a Committee for the purpose of investigating the advantage of applying a system of Contouring to the Ordnance Maps, and reporting our opinion,

- 1st. " Whether the advantages to the Public to be derived from the exhibition
" of Contour lines on the Ordnance maps are commensurate with the cost
" of their production; and

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- 2d. " Whether the advantages which are derivable from this System may or
" may not be attained to a sufficient extent, and at a considerably less cost
" by the adoption of any other process."

We have the honour to report as follows :

We have held several meetings at the Ordnance Office, and have been assisted by the attendance of Lieut-Colonel Dawson, Royal Engineers, and Captain Gosset, Royal Engineers, both of them of much experience in great National Surveys.

1. That a Map founded on a National Survey should have recorded upon it numerous Surface Levels laid down with great accuracy.

2. That levels should be taken on certain principal lines, and at defined prominent points, selected upon some well established principle, and such in particular as can be easily identified subsequently ; the levels should be given in feet, and with one or two places of decimals in addition, according to circumstances, and inserted in each of the Maps proposed, to an extent proportionate to their respective Scales.

3. That primary levels will be more practically useful when given upon roads, and highways, railways and canals, and on bridges, milestones, churches, and other substantial buildings, tops of hills, and all well defined summits, as well as along streams and water-courses ; on most of these situations will be found permanent surfaces on which the levels should be distinctly inlaid and marked for future reference ; and at many other sites, artificial bench-marks should be fixed in a very permanent manner ; for the levels given on a Map may be considered as of more or less practical utility in proportion as they can be at any time ascertained with precision on the ground.

4. That the levels as above described having been provided, Contour lines to a certain extent would be an useful addition to a Map on the Six-inch Scale, and well worth an outlay of 5s. per lineal Mile, this being the cost of Contouring, as estimated by Captain Gosset, on the assumption that the levels above mentioned have been previously obtained and recorded ; these Contour lines should be instrumentally traced with accuracy, and the system of interpolating Contour lines should be abandoned.

5. That Contour lines selected from those obtained for the large Surveys (if of a different colour) would be an useful addition on the One-inch Map ; but on Maps of a larger Scale, of 24 or 26 inches, they would be inexpedient.

6. That in those districts to which the large Scale of 24 or 26 inches to the Mile is already applied, it would be most desirable that a reduction should be made and published on the Six-inch or some intermediate Scale between the large Plans and the One-inch Map.

In conclusion, we would very particularly and earnestly press upon Your Lordships' attention the extreme importance of expediting in the greatest possible degree the completion of the general One-inch Map, in the preparation of which the most improved System of representing the features of the Country should be employed. Every Class of Society is interested in this question, and scarcely any public work can be undertaken, the progress of which may not be influenced in a greater or less degree by the result of Your Lordships' determination thereon.

We trust, therefore, that no question of Contouring will be allowed to delay that Work of first-rate importance; the Contour lines that have been already completed may be introduced in a different colour on the Maps of that scale, but the publication of a first impression of the remainder should not be deferred for a similar addition, and we would submit that the completion of the One-inch Map within the shortest practicable period is well worth the moderate additional expense that it would entail upon the Survey; and that a sufficient additional Annual Grant should therefore be obtained for this particular purpose, and generally for carrying out the views which we have ventured to suggest.

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(Signed) ELLESMERE.
WROTTESLEY.
I. K. BRUNEL.
J. F. BURGOYNE.
RODK. MURCHISON.
H. T. DE LA BECHE.
CHARLES VIGNOLES.
LEWIS. D. B. GORDON.
JAS. M. RENDEL.

No. 12.

TREASURY MINUTE, *dated July 28, 1854.*

Transmit a Copy of this Report to the Secretary to the Ordnance, and request that he will state to the Master General and Board that the recommendations contained in it, relative to the mode of recording the Surface Levels of the Country, should, in their Lordships' opinion be acted upon in future, in the conduct of the Ordnance Survey.

Also state that My Lords are of opinion, that the Cost, per lineal mile, of Contouring in the manner specified by the Committee, after the levels above mentioned have been obtained and recorded, should be ascertained by actual experiment.

No. 13.

SIR CHARLES TREVELYAN TO LIEUT.-GENERAL SIR JOHN BURGOYNE, G.C.B.

Treasury Chambers, August 3, 1854.

With reference to the recommendation contained in the Report of the Committee on Contouring, dated 20th Ultimo, that in the preparation of the general One-inch Map, "the most improved System of representing the features of the Country should be employed," I am commanded by the Lords Commissioners of Her Majesty's Treasury to request that you will state for their Lordships' information, more particularly, what mode of representing the features of the Country the Committee had in view in making the above recommendation.

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No. 14.

LIEUT.-GENERAL SIR JOHN BURGOTNE TO SIR CHARLES TREVELYAN.

SIR,

Ordnance Office, London, August 3, 1854.

In reply to your letter of this day, requesting that I would state what mode of representing the features of the Country the Committee had in view in recommending that "on the One-inch Map, the most improved system of representing the features of the Country should be employed," I think I can with great confidence state that the recommendation had in view hill-sketching on the ground, and hill-drawing on artistic principles, to which they proposed should be added selected Contours from those that might be authorized for the larger Surveys, if they could be laid on the Maps of a different colour.

No. 15.

TREASURY MINUTE, *dated August 4, 1854.*

Transmit copies of the Letter to Sir J. Burgoyne, dated 3d instant, and of his Reply to the Secretary to the Ordnance, and request that he will state to the Master General and Board that their Lordships are of opinion that in the preparation of the general One-inch Map, the features of the Country should be represented in the manner described in Sir John Burgoyne's letter.

APPENDIX.

No. 1.

LETTER from Mr. G. B. GREENOUGH, F.R.S., to Sir C. TREVELYAN, with Extracts from his Address to the Royal Geographical Society, May 24, 1841, relative to an improved System of Mapping.

Regents Park, July 22, 1854.

I HAVE the honour through you to offer to Government the free use of the Copper plate, containing a Natural Scale of Heights, constructed some years ago for presentation to the Royal Geographical Society; and I shall be happy to hear that a more extended circulation will be afforded to that document by its insertion in the forthcoming Report upon the proposed Ordnance Map of Scotland.

I beg leave also to inform you that I shall esteem it an honour if it should be thought proper to append to that Report the subjoined passages from my Address to the Royal Geographical Society, as having immediate reference to the principal subjects therein discussed.

(Signed) G. B. GREENOUGH.

To Sir Charles Trevelyan, K.C.B.,
 &c. &c. &c.

No. 2.

EXTRACT from the ADDRESS.

"The only sound basis for geography in general is physical geography. Civil, political, and all other kinds of geography are merely grafts upon this original stock. Our first aim should be to construct, I will not say a perfect map of the surface of the earth, but rather a perfect model; I know that this cannot be constructed at once, nor perhaps in the course of centuries; but we should always look to it as the goal of our labours, moving, however slowly, in the right direction.

"The Ordnance Map of England being found insufficient for the present and ever-growing wants of the country, a proposition has been brought forward to increase its scale from 1 to 6 inches to the mile, the scale adopted in that of Ireland. Rejoicing as I do in this event, I cannot forbear saying, that before any final decision is come to, Government should consider well whether a 6-inch scale will be adequate to all the objects for which such a map is required or likely to be required, remembering always that by reducing a large map you may diminish its imperfections till they become perfectly insignificant, while by enlarging a small one you may magnify them till they become monstrous; this, however, is a question of economy rather than of science.

"That the *proposed* map should clearly represent the surface-form of the country, follows necessarily from what has been said; but it should comprise more: it should be constructed not for one purpose only, but for all imaginable purposes; the names and signs and boundaries inserted in it cannot be too numerous, supposing, of course that the positions of these are correct; the only mischief that can be apprehended is lest they should be too few: the desideratum being not selection, but accumulation. The value of a colossal map of this miscellaneous character, too bulky to be often consulted, too costly to be purchased by many, would consist mainly in the facility which it would afford to artists to extract from the immense quantity of matter contained in it, such information only as belonged to any one head of inquiry, and transfer that information to maps of a convenient size, so as to illustrate every subject at last, but one only at a time. From this, which I call, for the sake of brevity, a Parent Map, might be raised a large progeny applicable to the demands of all public boards and private individuals: financial maps, municipal maps, military maps, orographic, hydrographic, geological, metallurgic, zoological, botanical, agricultural maps, county maps, parish maps, road maps, historical maps, might all be composed with great facility at very little comparative cost, and far more excellent than any which at present exist, from this one great national map of reference, which need not, perhaps, be engraved for publication.

"A Map of the nature here suggested should, in respect to accuracy and completeness, possess in a great degree the characteristic merits of a photogenic drawing, in which there is no discrimination, no error, no omission; it should be in the first instance as far as possible, an accurate portrait of the present; which, by lapse of time, must soon become the past; the Original would then resolve itself into an historical document; but a copy produced by the electrotype, allowing the omission of all that had passed away, and the insertion of all that had sprung up in the interval, might now become, what its predecessor had been, the mirror, as it were, of all existing objects.

"Having incidentally mentioned the art of photogenic drawing, I cannot omit to notice one obvious advantage which belongs to it, an advantage which, in deference to short-sighted considerations, has, till lately, been but too often disregarded in the conduct of national surveys. The delineation of a photogenic drawing is immediate; that of a survey slowly progressive. I could name a survey which has already outlived its jubilee—if that circumstance did not entitle it to plenary indulgence. The face of a country undergoes strange alterations within a period of fifty years.

"I return to the subject of mapping *generally*; of that beautiful contrivance which I know not whether to class with the fine arts or with the exact sciences, so intimately is it connected with both.

"Mapping among its other merits may be designated the perfection of short-hand; many folio volumes of letter-press would not contain all the precise and various intelligence, the mutual relations and affinities, the contrasts and approximations, which are simultaneously brought into view in a single-sheet map of any kingdom.

"Mapping, considered in the light of short-hand, has another advantage: ordinary stenography is for the most part a secret art, with difficulty legible even to him who employs it; geographical stenography is not only intelligible, but immediately understood by entire Christendom.

"We have in this species of composition, as in music, algebra, chemistry, the elements at least of what with some little laxity of expression may be called an universal language. May not this language be further improved?

"How much confusion would be avoided were the standard of horizontal dimension an universal standard! and, amongst geographers at least, there seems no good reason why it should not be such. Who has not been embarrassed by the laborious, if not fruitless, attempt to compare maps of different countries, or of the same country, constructed by persons of different nations? how often have we not been foiled in our attempts to reconcile the English league to the Spanish, the Spanish to the French, the French to the German, the German to the Italian! How indifferent is the comparison, even when assisted by tables of numbers expressing the relation of their respective lengths!

"The geographic or nautical mile and its subdivisions, when not used exclusively, ought to be an invariable accompaniment of local scales, or of the numbers which indicate the proportion between the dimensions of any given map and those of reality; it was constantly employed by the early geographers; and those who feel no great respect for antiquity may yet perhaps allow that the circumstance of its dimensions being *universally known* demands the continuance of its use. On this ground, its universal intelligibility, M. Jomard proposes a new application of the geographical mile, expressing by it and its subdivisions the amount of heights when accompanied by a positive sign, and of depths when accompanied by a negative."

No. 3.

A NATURAL SCALE of HEIGHTS, by the application of which the Measures of different Countries are reduced to a common Measure known to all Geographers.

The object of the accompanying table is to supply Geographical Students with a standard by which they may compare the notations of vertical distances contained in foreign works.

At present the barometrical observations of learned foreigners are frequently expressed in French metres, in Pieds du Rhin, in Pieds de Berlin, in Paris feet, palmes, varas, &c., &c., rendering it necessary to enter into long calculations before comparative results can be obtained. It is hoped that the present Table will obviate this difficulty.

The standard selected has been the Geographical mile taken at the equator, this being a *fixed* quantity universally known and dependent upon the figure of the Earth itself. By taking five of these miles and dividing each into 100 parts or degrees, a scale is formed consisting of 500 degrees, each of which is equal to $60\frac{3}{4}$ English feet.

By this arrangement the Student of every nation will find no difficulty in at once referring unfamiliar measures not only to *one philosophical term*, but to the standard to which he is himself best accustomed. If for instance it be stated that an observed elevation is equal to 11,956 Pieds de Berlin, a glance at the scale will show that this is equal to 200 degrees, or two Geographical miles, and carrying the eye along the line a ready comparison may be instituted with any other standard measure desired.

Comparative View of the various Standards commonly used by Geographers to express vertical Distances &c.

5 Geographical Miles at the Equator	French Feet (Metres)	5 Geol. Miles at the Equator	French Feet (Pieds du Roi)	5 Geol. Miles at the Equator	English Feet	5 Geol. Miles at the Equator	Benarant Feet	5 Geol. Miles at the Equator	Danish Feet	5 Geol. Miles at the Equator	Swedish Feet	5 Geol. Miles at the Equator	Spanish Feet	5 Geol. Miles at the Equator	Dutch Feet (Pieds du Rhin)	5 Geol. Miles at the Equator	Austrian Feet (Wiener-Masses)	5 Geol. Miles at the Equator	Portuguese Palmes	5 Geol. Miles at the Equator	Roman Fathoms	5 Geol. Miles at the Equator	Prussian Feet (Berlin-Pass)
1	27000	1	27000	1	27000	1	27000	1	27000	1	27000	1	27000	1	27000	1	27000	1	12	1	10000	1	27000
2	54000	2	54000	2	54000	2	54000	2	54000	2	54000	2	54000	2	54000	2	54000	2	24	2	20000	2	54000
3	81000	3	81000	3	81000	3	81000	3	81000	3	81000	3	81000	3	81000	3	81000	3	36	3	30000	3	81000
4	108000	4	108000	4	108000	4	108000	4	108000	4	108000	4	108000	4	108000	4	108000	4	48	4	40000	4	108000
5	135000	5	135000	5	135000	5	135000	5	135000	5	135000	5	135000	5	135000	5	135000	5	60	5	50000	5	135000
6	162000	6	162000	6	162000	6	162000	6	162000	6	162000	6	162000	6	162000	6	162000	6	72	6	60000	6	162000
7	189000	7	189000	7	189000	7	189000	7	189000	7	189000	7	189000	7	189000	7	189000	7	84	7	70000	7	189000
8	216000	8	216000	8	216000	8	216000	8	216000	8	216000	8	216000	8	216000	8	216000	8	96	8	80000	8	216000
9	243000	9	243000	9	243000	9	243000	9	243000	9	243000	9	243000	9	243000	9	243000	9	108	9	90000	9	243000
10	270000	10	270000	10	270000	10	270000	10	270000	10	270000	10	270000	10	270000	10	270000	10	120	10	100000	10	270000
11	297000	11	297000	11	297000	11	297000	11	297000	11	297000	11	297000	11	297000	11	297000	11	132	11	110000	11	297000
12	324000	12	324000	12	324000	12	324000	12	324000	12	324000	12	324000	12	324000	12	324000	12	144	12	120000	12	324000
13	351000	13	351000	13	351000	13	351000	13	351000	13	351000	13	351000	13	351000	13	351000	13	156	13	130000	13	351000
14	378000	14	378000	14	378000	14	378000	14	378000	14	378000	14	378000	14	378000	14	378000	14	168	14	140000	14	378000
15	405000	15	405000	15	405000	15	405000	15	405000	15	405000	15	405000	15	405000	15	405000	15	180	15	150000	15	405000
16	432000	16	432000	16	432000	16	432000	16	432000	16	432000	16	432000	16	432000	16	432000	16	192	16	160000	16	432000
17	459000	17	459000	17	459000	17	459000	17	459000	17	459000	17	459000	17	459000	17	459000	17	204	17	170000	17	459000
18	486000	18	486000	18	486000	18	486000	18	486000	18	486000	18	486000	18	486000	18	486000	18	216	18	180000	18	486000
19	513000	19	513000	19	513000	19	513000	19	513000	19	513000	19	513000	19	513000	19	513000	19	228	19	190000	19	513000
20	540000	20	540000	20	540000	20	540000	20	540000	20	540000	20	540000	20	540000	20	540000	20	240	20	200000	20	540000
21	567000	21	567000	21	567000	21	567000	21	567000	21	567000	21	567000	21	567000	21	567000	21	252	21	210000	21	567000
22	594000	22	594000	22	594000	22	594000	22	594000	22	594000	22	594000	22	594000	22	594000	22	264	22	220000	22	594000
23	621000	23	621000	23	621000	23	621000	23	621000	23	621000	23	621000	23	621000	23	621000	23	276	23	230000	23	621000
24	648000	24	648000	24	648000	24	648000	24	648000	24	648000	24	648000	24	648000	24	648000	24	288	24	240000	24	648000
25	675000	25	675000	25	675000	25	675000	25	675000	25	675000	25	675000	25	675000	25	675000	25	300	25	250000	25	675000
26	702000	26	702000	26	702000	26	702000	26	702000	26	702000	26	702000	26	702000	26	702000	26	312	26	260000	26	702000
27	729000	27	729000	27	729000	27	729000	27	729000	27	729000	27	729000	27	729000	27	729000	27	324	27	270000	27	729000
28	756000	28	756000	28	756000	28	756000	28	756000	28	756000	28	756000	28	756000	28	756000	28	336	28	280000	28	756000
29	783000	29	783000	29	783000	29	783000	29	783000	29	783000	29	783000	29	783000	29	783000	29	348	29	290000	29	783000
30	810000	30	810000	30	810000	30	810000	30	810000	30	810000	30	810000	30	810000	30	810000	30	360	30	300000	30	810000
31	837000	31	837000	31	837000	31	837000	31	837000	31	837000	31	837000	31	837000	31	837000	31	372	31	310000	31	837000
32	864000	32	864000	32	864000	32	864000	32	864000	32	864000	32	864000	32	864000	32	864000	32	384	32	320000	32	864000
33	891000	33	891000	33	891000	33	891000	33	891000	33	891000	33	891000	33	891000	33	891000	33	396	33	330000	33	891000
34	918000	34	918000	34	918000	34	918000	34	918000	34	918000	34	918000	34	918000	34	918000	34	408	34	340000	34	918000
35	945000	35	945000	35	945000	35	945000	35	945000	35	945000	35	945000	35	945000	35	945000	35	420	35	350000	35	945000
36	972000	36	972000	36	972000	36	972000	36	972000	36	972000	36	972000	36	972000	36	972000	36	432	36	360000	36	972000
37	999000	37	999000	37	999000	37	999000	37	999000	37	999000	37	999000	37	999000	37	999000	37	444	37	370000	37	999000
38	1026000	38	1026000	38	1026000	38	1026000	38	1026000	38	1026000	38	1026000	38	1026000	38	1026000	38	456	38	380000	38	1026000
39	1053000	39	1053000	39	1053000	39	1053000	39	1053000	39	1053000	39	1053000	39	1053000	39	1053000	39	468	39	390000	39	1053000
40	1080000	40	1080000	40	1080000	40	1080000	40	1080000	40	1080000	40	1080000	40	1080000	40	1080000	40	480	40	400000	40	1080000
41	1107000	41	1107000	41	1107000	41	1107000	41	1107000	41	1107000	41	1107000	41	1107000	41	1107000	41	492	41	410000	41	1107000
42	1134000	42	1134000	42	1134000	42	1134000	42	1134000	42	1134000	42	1134000	42	1134000	42	1134000	42	504	42	420000	42	1134000
43	1161000	43	1161000	43	1161000	43	1161000	43	1161000	43	1161000	43	1161000	43	1161000	43	1161000	43	516	43	430000	43	1161000
44	1188000	44	1188000	44	1188000	44	1188000	44	1188000	44	1188000	44	1188000	44	1188000	44	1188000	44	528	44	440000	44	1188000
45	1215000	45	1215000	45	1215000	45	1215000	45	1215000	45	1215000	45	1215000	45	1215000	45	1215000	45	540	45	450000	45	1215000
46	1242000	46	1242000	46	1242000	46	1242000	46	1242000	46	1242000	46	1242000	46	1242000	46	1242000	46	552	46	460000	46	1242000
47	1269000	47	1269000	47	1269000	47	1269000	47	1269000	47	1269000	47	1269000	47	1269000	47	1269000	47	564	47	470000	47	1269000
48	1296000	48	1296000	48	1296000	48	1296000	48	1296000	48	1296000	48	1296000	48	1296000	48	1296000	48	576	48	480000	48	1296000
49	1323000	49	1323000	49	1323000	49	1323000	49	1323000	49	1323000	49	1323000	49	1323000	49	1323000	49	588	49	490000	49	1323000
50	1350000	50	1350000	50	1350000	50	1350000	50	1350000	50	1350000	50	1350000	50	1350000	50	1350000	50	600	50	500000	50	1350000

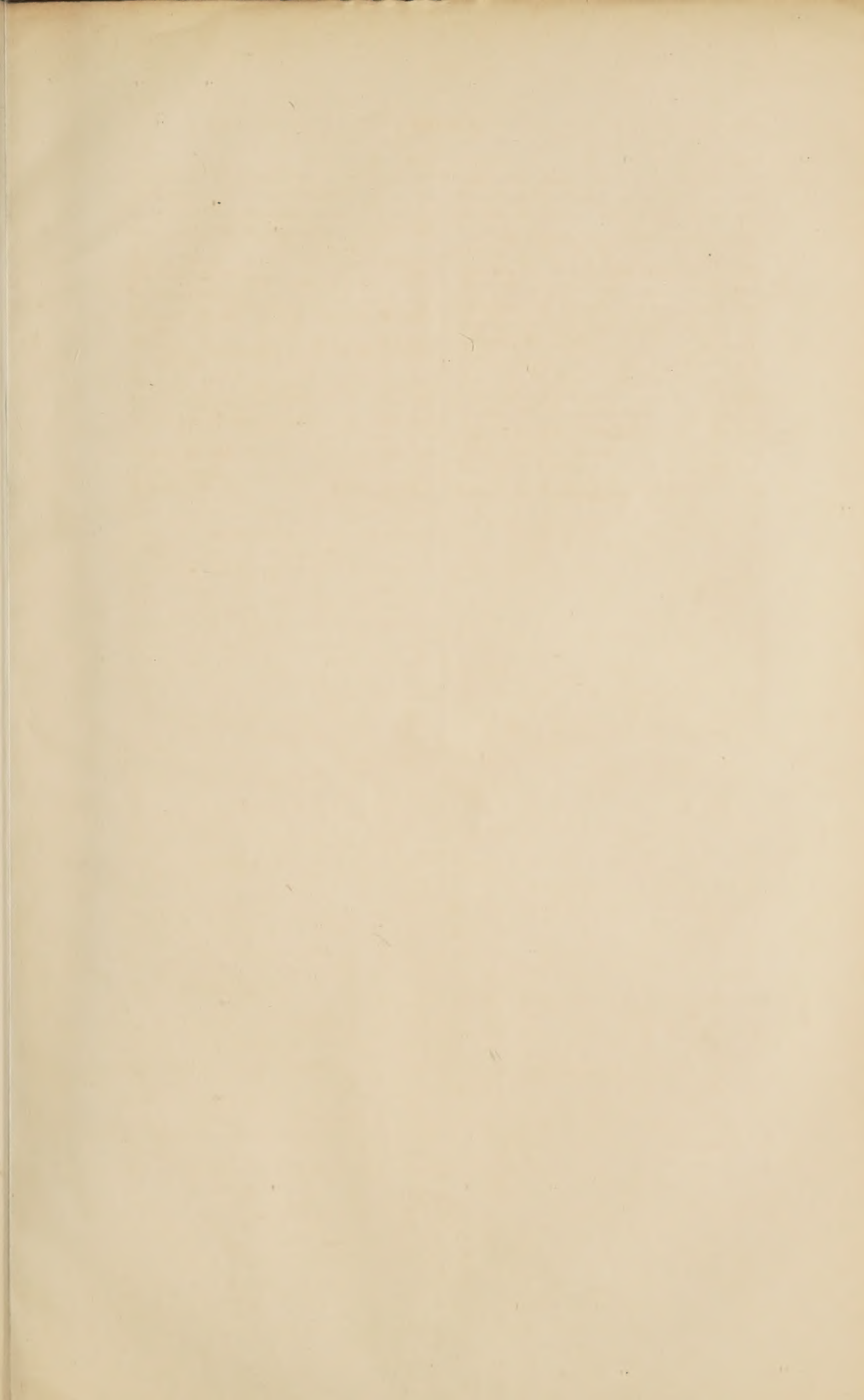
The scale represents 5 geographical miles taken at the Equator each mile is divided into one hundred degrees The left hand column shows the corresponding value in the standards most

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ORDNANCE MAPS.

CORRESPONDENCE

RESPECTING

THE SCALE FOR THE ORDNANCE SURVEY;

AND UPON

**CONTOURING AND HILL
DELINEATION.**

Presented to both Houses of Parliament by Command of Her Majesty.



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